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EDITORIAL

Forestry at the Cross Roads

THE CENTRAL theme at the annual meeting of the Society of American Foresters in San Francisco next month will be the state of the Society's leadership in forestry matters. Is it continuing with its early vigor or is it showing evidence of debility?

The concepts of what forestry includes are changing and broadening. Once, conservation of timber supplies was emphasized; now recreation, watershed protection, wild life and other developments demand a large share of our attention. There is no gainsaying that the original forestry movement was eminently successful in winning public acceptance of the forestry idea—federal management of timber resources still remaining in public lands, the forestry responsibilities of the states, fire protection, research and other fundamental endeavors. Forestry has been unique among technical professions. Since its inception it has been interested not only in technological problems but also in their social and political aspects. The profession saw clearly the significance to the Nation of what was happening to forest lands and acted with vigor. Perhaps it is now the victim of its early enthusiasms. In the actual execution of forestry practice on those lands on which it is most urgently needed, the accomplishment is not so great. Industrial forestry, with a few glowing exceptions, hardly exists. We have not yet developed a really workable forest tax system; we have no workable plan for making private forest lands continuously productive; we have found no solution for the glutting of markets with lumber, or for maintaining the preëminant position of our major product—lumber; in rehabilitating denuded lands we have only scratched the surface. Other failures might be mentioned. Something is wrong.

"A fresh outlook and perspective are badly needed. The last decade has been characterized by lack of foresight and positive leadership. Current problems are ill defined and handled with little regard to their relative importance to mention only such things as the lamentable breakdown of private ownership of forest lands, the failures to provide for rational treatment of important watershed areas, the serious weakness and inadequate treatment of recreational values of wild lands. All these go beyond the original concept of forestry in America and all need clear recognition today." This quotation from

a clear-thinking member of the Society reflects the feeling of many. Have the early leaders kept up with the changing times and problems, or have they lapsed into a self-satisfied complacency or the reiteration of outworn formulas? If the latter, where are the young Davids to challenge Goliath? The younger generation is thought by some to be indifferent and to be drifting, intellectually. If this is so it is a challenge the young generation must meet. There is plenty of evidence, however, that it is breaking away from old concepts and is feeling its own way; but it is strangely inarticulate.

It is not meaningless advertising to refer to the 1932 annual meeting as one of the Society's most important. It is true that we have been drifting too long, and permitting our leadership to lose strength and vitality. Further delay in reasserting principles and action in putting them into practice is fatal and may cause the lapse beyond repair of the possibility attaining those constructive objectives which the Society was formed. The nual meeting this year will be rea accessible to western foresters for the time since 1927. The greater distance the eastern foresters, however, should deter them from attending. (The has been fixed to avoid interference Christmas-at-home.) The seriousness the matters to be discussed warrant heavy attendance from West and E Particularly should the younger memb those who are trying to find their p in Society affairs, attend. It will be opportunity for them to show whethe not they are prepared to take up work that is yet to be done. For older members it should mean rene growth.

TECHNICAL FOREST PRACTICES IN NEW YORK REFORESTATION WORK[1]

By THE COMMITTEE ON TECHNICAL PRACTICES

New York Section, Society of American Foresters

THE COMMITTEE ON Technical Practices met on September 2, 1931 at Poughkeepsie and decided upon he subject of reforestation for prelimi- iary investigation since this had a high legree of importance in view of work ahead under the plan of the Hewitt Amendment.

The following assignments were made at the meeting:

1. History of species and class of stock grown for reforestation purposes and its distribution. Purpose to ascertain what he trends have been in the past and the easons therefor. (Assigned to Littlefield.)

2. Fire lanes and trails in plantations. Basic material that governs future management and utilization. (Assigned to Heiberg.)

3. Methods of planting. Investigation n a county or counties or other division of the state to ascertain how trees are being set. (Assigned to Spring.)

4. Improvement of planting stock. Basic considerations and, particularly, the rend in practice of planting stock production. (Assigned to Foster.)

Reports on three of these topics are eady for presentation today. Heiberg has been unable to prepare his report because of absence in Europe during the past six months.

The chairman presents the following statement by way of introduction:

The plan of reforestation of lands submarginal for agricultural use demands he highest technical judgment and skill. t is the time now for whole-hearted coöperation of all agencies to meet the problems in this big-scale planting program. That should not merely receive approval by members of the Section as a sentiment, but it should result in a definite conference of the agencies and the laying out of a program of research. We cannot afford to have the next generation curse us for avoidable mistakes. Some of the phases needing investigation are:

1.Choice of species in relation to site.

2. Methods of production of suitable forest nursery stock.

3. Preparation of the site in relation to tree survivial, growth, and the total cost of planting.

4. Methods of handling stock and of planting it; relation to survival.

5. Division of plantations and the arrangement in relation to future protection and utilization.

6. Replanting.

7. Possibilities of fertilizing plantations on poor sites.

As a step preliminary to more extended work, the Committee presents three phases of reforestation for constructive criticism of the members of the New York Section at this meeting.

S N. Spring, *Chairman.*

Trend of Demand for Certain Coniferous Species for Planting in New York State

BY E. W. LITTLEFIELD

During the past few months a preliminary study of the trend of demand for

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[1]Presented at the annual meeting of the New York Section of the Society of American Foresters, at Albany, N. Y., January 29, 1932.

state planting stock has been attempted, making use of the records on file at the Conservation Department in Albany, through the coöperation of Mr. A. F. Amadon, in charge of Operation of Nurseries and Tree Distribution, to whom the report has been submitted for comment and criticism. The study was undertaken in collaboration with Mr. Stuart S. Hunt of the Conservation Department who had already assembled a certain amount of data along that line in connection with his plantation studies. Much of the mechanical work of transferring and tabulating the data was done by Messrs. M. W. Humphrey and F. A. Culley, Assistants in the Department.

In attempting to define the trend of demand for one or more species it was evident that such a demand could be indicated only by the so-called "private" orders, (i.e. excluding orders for trees to be planted on state land) since in the majority of years (at least up to 1928) the trees used on state land have represented to a large extent the surplus stock left over from private orders. For present purposes, orders for county plantings have been eliminated also because it is felt that the large size of single county orders in any one year might overbalance the general trend in that county.

It was originally intended to include the entire state within the scope of the study, but the amount of time involved was found to be such that it was thought better to take a few counties at a time and gradually, if the project seemed worth while, build up a complete record. Three counties, Essex, Otsego and Oneida, were selected for the preliminary report; first, because the writer was personally familiar with conditions existing in these counties and, also, because they seemed to be representative of three distinct regions of the state, namely: (1) The Eastern Adirondacks, (including a part of the Champlain Valley), (2) the plateau region which extends westerly fro the Catskills through the southern cou ties and (3) Central New York compri ing, in the case of Oneida County, t headwaters of the Mohawk and Bla Rivers and a fringe of the western Ad rondack plateau. Each of these regio has definite local problems and prefe ences in connection with forest plantin and has been active in reforestation wo since the commencement of the state-wi program in 1909. The private orde alone in these counties total 16 millio trees, and with the inclusion of state an county orders the total is 39 million about 16 per cent of the state tot through 1931.

Only four species have been taken in consideration; namely: White pine, Scot pine, red pine and Norway spruce, sin these constitute the bulk of all the tre which have been planted in the state f reforesting purposes. (For the counti under consideration, the number of tre of the species named made up 83 p cent of all trees planted from 1909-1931

In order to show the comparative tre of demand for the different species ov the entire period, it was found necessa to group the number of trees by secon ary periods, rather than attempt to pl them by single years. By this metho the fluctuations due to large individu orders, or other factors, in any one ye have been largely though not entire eliminated. In the matter of groupin another factor enters, that of time dist bution. For instance, the bulk of all t trees ordered for the entire period fro 1909-1931 are those ordered since 192 Beginning with that year, a marked a celeration took place in the state progra of tree distribution resulting in an i crease in the annual output of the sta nurseries from a little over four millio in 1922 to over 25 million in 1929. Th in the case of Essex, Otsego and Onei counties, taken together, the average a

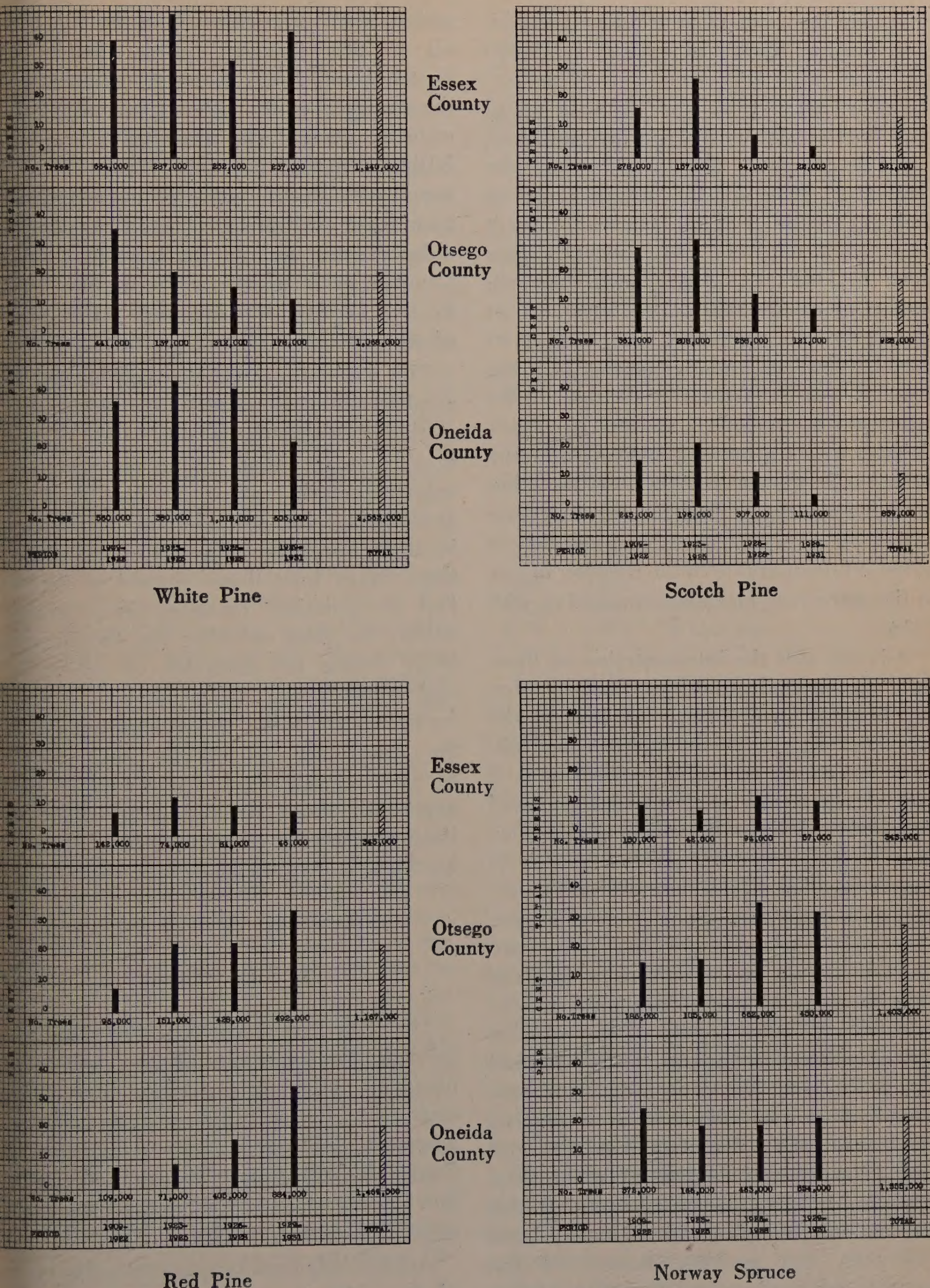

Fig. 1.—Tree distribution by the New York Conservation Dept., 1909-1931, showing comparative trend of demand.

nual call for trees from 1909 to 1922 inclusive was 315,000 as against 1,319,000 per year from 1923 to 1931. Moreover, the distribution from year to year up to 1922 was so erratic that no definite trend could be observed. For these reasons, the years from 1909 to 1922 were grouped as a single period, and the remaining years from 1923 to 1931 were grouped into three periods of 3 years each. An examination of the tabulations made up on this basis will show that the number of trees for the first period, covering fourteen years is not far from the average of the other three periods (except in Essex County, where a large amount of planting was done in the early years). On the other hand, the number of trees for any three-year period prior to 1922, in these counties, is not at all comparable to the number in any of the three-year periods commencing with 1923.

It is felt that the interpretation of these data, represented graphically and in tabular form[1] is primarily a function of the other members of the committee on Technical Practices, and of the Section as a whole, rather than of those who prepared the report. It may be worth while, however, to bring out one or two points in this connection. It is interesting for example, to note that Essex County is completely at variance with the other two counties in the matter of white and red pine, having ordered white pine consistently up to the present time, whereas there has been no increase in the demand for red pine. The writer believes that three factors are influential in producing this result. (1) An abundance of land now growing white pine or other land naturally adapted to the planting of this species. (2) A high appreciation by local mill men and woodlot owners of the value of white pine lumber with a corresponding disregard for red pine. (3) Less serious damage to white pine by the wee vil in this section. In the matter · Scotch pine, Essex County has followe the example of the other two and of th state in general, by showing a steadi falling demand in recent years. This supposedly due in part to the prevailin poor form exhibited by Scotch pine in th older plantations and (at least in Oneid County) to the publicity given since 19 to the Woodgate Rust and other pes of this species.

The point, in general, which should l emphasized with respect to a study su as this is, is that the private forest plant in various localities of the state has d veloped certain rather definite ideas r garding species suitable for reforestin in those localities. The extent to whi these ideas have been shaped or mod fied by technical foresters, as a grou within the state, whether the trends n being shown are desirable or otherwis and whether we, as technically train foresters, are utilizing to best advanta the experience gained by the priva planter in the state-wide reforestation pr gram—all these are points which I b lieve are worthy of serious considerati by the members of the New York Sectio

Methods of Planting

BY S. N. SPRING

The data here presented were obtain through the courtesy of the followi persons: Allen J. Collins, County Fo ester, Erie County; James E. Davis, D partment of Forestry, Cornell Universit Paul T. Gillett, County Forester, Chauta qua County; C. W. Mattison, County Fo ester, Jefferson County.

Acknowledgment is also gratefully ma of the assistance of Mr. Davis, and gra uate students Wilm and Richey at Co

[1]Not reproduced here. *Ed.*

nell University in compiling and interpreting that data.

The material which follows is intended to be suggestive and is presented as a preliminary report only.

Information was solicited in counties representative of somewhat different conditions. A letter from P. T. Gillett, Forester of Chautauqua County, gives a general view in his county as follows:

"We have planted in Chautauqua County very close to three million forest trees since the work started in 1909. It is safe to say that the first few years of planting were not satisfactory, since the species of trees and adequate planting instructions were not available. I can locate very few successful plantations established prior to 1912, and those from 1912 to 1920 have not, as a whole, been particularly satisfactory. Probably the average survival percentage would be from about fifty to sixty. Since that time, however, because of more definite information and better species, the percentage of survival under our conditions has been quite satisfactory, varying from seventy to one hundred.

"The method of planting generally used is the mattock slit and a combination of this and a skinning off of hard matted turf where sod conditions are particularly bad.

"Survival with two-year old seedlings has not been satisfactory because of two factors; one, heavy sod in most cases; two, fall heaving on our volusia soils. On county-owned plantations our survival has in no case been less than 80 per cent, and has averaged much nearer 90 per cent. This includes all species put out by the Conservation Department with the exception of white cedar and European larch. My only reason or guess for this is that we are too far from any of the state nurseries to make it advisable to have them shipped in in the spring, since they leaf out so early and therefore provide for trouble in heating in transit. Fall planting is not advisable because of our heavy soils.

"White cedar plantings have been successful as far as survival goes, though the growth on our acid soils is very slow. From my observations it seems as though red pine is the best suited for most of our plantations, with white pine (regardless of weevil injury) and the spruces coming next in line. Black locust has been grown very successfully on the limy soils in the county, but these areas are very small."

A report on certain private plantations on gentle eastern slopes in gravelly loam is presented in Table 1 as an example of planting methods and results in general in Chautauqua County.

TABLE 1

PRIVATE PLANTATIONS—CHAUTAUQUA COUNTY, N. Y.

Year	Number of trees	Species	Age of stock	Survival per cent
1921	2,000	Scotch pine	4	90
1924	1,000	Scotch pine	3	90
1924	1,000	Red pine	3	80
1925	2,000	Scotch pine	3	95
1926	5,000	Scotch pine	3	90
1927	5,000	Scotch pine	3	80
1928	3,000	Scotch pine	3	85
1928	2,000	White cedar	2	60
1929	1,000	White pine	4	80

Perhaps the best gauge of survival is that of the 4H boys and girls work who engaged in planting as a home project in extension. These boys and girls were trained by attending a planting demonstration and themselves setting some trees for practice. Mr. Davis selected data of such planting in Oneida and Delaware Counties for which prizes are given. The mode of planting was the mattock-slit method. The result of 77 plantations of 1,000 trees each, excepting two that had 1,500, is given in Table 2 for all species together by classified per cent of survival and for 45 plantations of 1,000 trees each, in Oneida and Delaware Counties, respectively.

Broadly one may conclude that careful planting under average site and seasonal conditions with result in a relatively high proportion of success.

Data of county plantations set out in Chautauqua, Erie and Jefferson Counties present some interesting information when compiled and compared. These planta-

tions were set out within the past decade and most of them during the last three years. Compiling for all species and sites and classifying by age, the results given in Table 3 are obtained.

planted by hand with mattock-slit metho sod not removed; and, 98 per cent usi mattock-slit method but removing the so

A study of plantations on Connecti Hill near Ithaca by two Cornell stude

TABLE 2

SURVIVAL BY CLASSIFIED PER CENT 4H PLANTATIONS

Number of plantations	County	Number of trees basis	Under 70 Per cent	70-79 Per cent	80-89 Per cent	90-100 Per cent
45	Delaware	45,000	17.8	4.4	16.6	61.1
77	Oneida	78,000	7.0	7.0	34.0	52.0

Calculation was made of the survival of different species on different soils but the kind of soil was not sufficiently clear to warrant definite conclusions. This is further complicated by lack of data on the ground cover, a very important factor. Broadly speaking, light loams, gravelly loams and loams served to give good survival for the three pines. Heavier soils appeared to be less favorable, judged by survival, but white pine, red pine and Norway spruce had good percents of survival. These statements are based on results with 1,000,000 or more trees. These data suggest the need of a careful survey by foresters on a standard set of points to be recorded concerning planting stock used, soil and ground cover of the site, aspect, method of planting, etc., followed by careful counts of surviving trees.

Individual experiences with the use of different methods of planting on given sites is much needed. We have too little data. No one single instance proves anything, but merely points the way. Davis, for example, mentioned to the writer one case worth consideration. The site was a light sandy loam on which was a thin stand of grass, some moss, some hardhack. The stock used was 2-year red pine seedlings. At the end of 1931, the first season, there survived 68 per cent of the machine planted; 50 per cent of those

two years ago indicated that planti without sod removal decreased heaving fall planted stock, but also showed undesirability of fall planting on cert aspects and on soils tending to hea One might add many other examples results in planting. The upshot of whole matter seems to the writer to c for systematic investigation by seve agencies of the state on a standard pla

TABLE 3

AVERAGE SURVIVAL OF TREES IN FOREST PLANTATIONS—CHAUTAUQUA, ERIE AND JEFFERSON COUNTIES

Age of trees set Years	Average survival Per cent	Basis number of tre
2	80	203,000
3	82	693,000
4	86	603,000
5	98	35,000

By method of planting the results pear in Table 4 for these plantations.

TABLE 4

Method	Survival Per cent	Basis number of tr
Slit	80	3,000
Mattock-slit	80	261,000
Hole[1]	90	460,000
Hole (sod removed)	84	810,000

[1]Whether sod was cut back was not stated

Improvements in Planting Stock Production

BY C. H. FOSTER

We have been growing trees for forest planting in the Northeast for some twenty five years. It is interesting to go back and see what changes have taken place during this time. Four heads of the oldest forest nurseries have contributed ideas to this report, to which the writer has added and interpreted the facts as he sees them.

In the early days a large percentage of the trees produced for planting were two-year seedlings. These thrived when planted under favorable conditions, but disastrous results followed when they were used on lands having heavy soil and rank ground cover. The planters then began to demand larger stock and hence the nurseries had to produce increasing quantities of transplants. The production of transplants necessitated more land and more working capital, which in some cases was difficult for the nurseries to obtain. It was necessary then to produce all the trees demanded, and at the same time keep the price as low as possible, in order not to discourage planters with high-priced trees. Perhaps in an effort to serve the public too well, or whatever the reason might have been, a decline in the quality of planting stock came. Seedbed densities were increased beyond reason. The two-year seedlings on the average became unfit for field planting. Even three-year transplants became so weak and puny that planters were forced to throw many of them away. The demand inclined from three-year to four-year transplants. Gradually the nurseries came to realize, that purely from a production standpoint, it was uneconomical to sacrifice quality for quanity.

The real improvement in forest planting stock started about five years ago, and it has been interesting to watch its progress. All those consulted agree, that the most important improvement in the quality of the stock now being produced has resulted from reducing the density in the seedbeds. However wide difference of opinion still exists as to what the ideal density should be to produce the best two-year seedlings, ranging from fifty to one hundred and fifty trees per square foot. Professor Toumey has found that the total dry weight per unit area is approximately the same at the end of two years where the density is fifty trees per square foot or five hundred trees per square foot. Hence if stocky plants are required for field planting proper growing space must be provided in the seedbeds.

More attention is now being given to proper fertilization of nursery soils. Covercropping is now in common practice. Sandy soils low in humus content are being built up chiefly by the use of good old fashioned barnyard manure, which is probably the best all-around fertilizer. Commercial fertilizers of high nitrogen content are found to be very effective in stimulating rank top growth, but there is a danger in excessive forcing. A relatively new idea of inoculating the nursery soil with beneficial mycorriza promises to be a new field which should be thoroughly investigated as a means of improving the soils.

The use of water has enabled nurseries on light sandy soil to produce better and more uniform-sized stock. Fall sowing of seed is giving excellent results, better germination, less loss from damping off and producing larger one-year seedlings. Seed selection has been accepted in principle. In the case of Scotch pine in particular, the nurseries have recognized the importance of securing seed from the right locality. With the native species there is still little proof that the seed of one locality is materially better than that of another. When there is an opportunity

to choose, most prefer local seed or seed from a locality possessing similar site factors.

Better organization and management of the nurseries, has played a very important part in producing better trees. Years of experience have taught how to plan the work and things are done on time. Improved equipment has helped cut losses and costs.

It seems worth while to discuss the old question of seedlings versus transplants since this is a matter of real importance and will doubtless have an important bearing on future nursery practice. Among the planters there are still strong advocates of seedling stock. Improved methods of nursery practice indicate that superior seedlings can now be produced. Large transplant stock, grown under improved conditions is becoming regarded as too large for economical forest planting. Since the nursery must have an insight into future demands it would be well to reëxamine this problem openmindedly.

Several nurseries are now experimenting with a new type of stock, the three-year root-pruned seedling. It has a quality which they believe makes it fundamentally a better tree than the transplant. The process of transplanting deforms the natural root system of the seedling, placing it in a vertical plane, and in many cases even making it hook shaped. The process of root pruning, allows the lateral roots to remain in their natural position. During the third growing season, the pruning having been done early that spring, these lateral roots develop and become stiff so that they retain their form when taken to the field to plant.

What difference does it make if the roots are rearranged in transplanting? Everyone knows that transplants have been used with success for years and a high percentage survive. Is this not proof that transplants are good reliable trees to plant?

The answer to this is that recent o servations have revealed some new an interesting facts. The old criterion of th success of establishment in a plantatio was to figure out the per cent of surviva but this is not enough. To be successf they must not only survive, but actual take hold and grow. We find in the ca of red pine plantations originating fro transplant stock only rare instances whi show ill effects from deformed root sy tems, deep planting, etc. Spruce on th other hand usually grows very slow after planting for three to five years an then after a new lateral root system h been established it seems to go on with normal growth. In the case of white pi in particular there is much evidence show that deformation of the root sy tem commonly causes a serious conditi of slow growth accompanied by a sick appearance and often slow death, depen ing on the degree of misplacement of t roots. It has been customary to pa over conditions of this sort by blami the planters but it is undeniable that t misshaped root systems contribute to th condition and in fact make so-called go planting practically impossible. The nu eryman knows that each transplanti materially sets back the growth of a tre unless moved with a ball of earth or u less much care is used in replacing t roots in a normal position. If then, t deduction that transplants with deform roots contribute to the slow establishme of plantations is correct, then it is, theo etically, sound practice to develop pla ing stock with normal lateral roots. T proof of this theory will soon be d termined.

A second advantage claimed for t three-year root-pruned seedling over t transplant is its lower cost of productio The saving in cost will only be accurate known after several more years of ref ing the process, but the indications a

that it will be between twenty and thirty per cent.

So it will be well for the nurseries to reëxamine this old question of seedlings versus transplants. It has been proved time and again in Europe that the smaller and younger the stock when used the better the root system is able to establish itself. With our improved knowledge and facilities for growing trees it seems certain that we can produce seedlings of suitable size at less cost and be sure they are fundamentally better than the transplants now in general use. This is a challenge for the immediate future.

The development of the briquette method of planting in Europe shows that nursery and planting practices have not yet reached the limits of their possibilities. In this method they have gone the limit in devising a system to eliminate the shocks of moving the tree from one place to another. The seed is planted in a block of earth and germinated and planted in the field without its roots being disturbed at all. In this respect the idea is good. Unfortunately most of our land in the Northeast has rank ground cover which will probably be severe on little one-year seedlings. The cost of production and transporting the stock will probably give it very little advantage.

There is a disposition on the part of the forest nurseries to improve. They are awake to the possibilities of developing new methods. They are willing to profit by the mistakes of the past. This all points to further advancement in nursery practice in the future.

Firewood is becoming scarce in Wisconsin and Illinois. The enormous consumption of it by railroads is fast exterminating the forests of our country. Two years ago, the price of cord-wood at Sodus Bay, N. Y., was $1.50 per cord; this year, Canadians from Toronto came over and purchased all that could be furnished for $2.50 per cord.

It will soon be worth while for all our cultivators to turn their attention to raising trees expressly for the supply of many of our towns with firewood. At present, wood is worth prices averaging $5 per cord, in Philadelphia. An acre planted with cherry—excellent firewood, and a very rapid growing tree—would be worth, at a rough estimate, $200 in ten years. As there are many tracts of land utterly useless for agricultural purposes, it is well to consider whether this sum per acre, without any labor, is not worth waiting for.

From *The Horticulturist,* February, 1857, Philadelphia.

CONTROL OF THE WHITE PINE WEEVIL

COMMITTEE REPORT[1]

New England Section, Society of American Foresters[2]

THE WHITE PINE WEEVIL (*Pissodes strobi*) has been extensively studied by entomologists and foresters in New England. The results of these studies have largely been published, so an abundance of valuable information is available.

The weevil is indigenous to the region in which it occurs and has not been introduced. The original stands in New England produced high quality eastern white pine (*Pinus strobus*) in spite of the presence of the weevil, so that the present extensive and apparently increasing damage by this parasite must result from a disturbance of the natural balance. Such a disturbance could be brought about by meteorological or other conditions unusually favorable to the insect or unusually unfavorable to the parasites and predators, although insect epidemics induced by meteorological conditions generally subside within a few years.

In New England, weighing all available evidence, it must be concluded that the present epidemic has resulted from the extensive areas of pure white pine indirectly and directly created by man. In the original forests of the region white pine grew largely in mixture, while pure stands occurred only occasionally. Extensive clearing of mixed stands for farm land was followed by widespread abandonment of these same lands, which reverted to forest again, largely being occupied by pure stands of white pine, the so-called "old fields." Furthermore, white pine, because of its aggressiveness and value, was chosen as the most desirable species for extensive planting and many pure plantations were established. This increase in compact masses of food supply for the weevil has enabled it to increase and cause extensive damage. In a recent paper Stafford (8, p. 44) points out that growing pure white pine on exhausted fields is probably the best method for cultivating weevils on an extensive scale.

Creating pure stands of a forest tree which does not grow pure naturally over extensive areas is frequently followed by serious difficulty. Experience in Great Britain with the larch canker fungus (*Dasyscypha willkommii*) on European larch (*Larix europaea*), in Great Britain and much of Germany with the aphid (*Adelges nüsslini*) on silver fir (*Abies pectinata*) and in Saxony with soil deterioration and insect and fungous parasites on Norway spruce (*Picea excelsa*) is conclusive evidence of this principle. Of course, the greater ease with which pure stands can be handled as compared to mixed stands is recognized and leads to a more extensive establishment of pure stands, particularly by artificial regeneration, than is warranted, considering all factors involved.

Nevertheless the white pine weevil is serious and methods both temporary and permanent must be applied for its control. The existing situation has been decades in developing; it can be remedied only by long-time, persistent work.

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[1]This committee was appointed in March, 1930 for the purpose of considering the present information on the control of the white pine weevil and suggesting promising investigations that might be attempted. The committee is indebted to R. B. Friend, H. J. MacAloney and H. B. Peirson for their coöperation.

[2]Presented at the winter meeting of the New England Section of the Society of American Foresters, at Boston, Mass., February 1-2, 1932.

Control

Since white pine is valuable not only s a forest tree but also as an ornamental, ontrol methods must differ. Methods hat can be applied to ornamental trees ill be impossible to use on forest trees ecause of prohibitive cost. A forest tree s a relatively low value commodity, but or control purposes an ornamental tree r plantation has whatever value the wner wishes to place on it. Again conrol may not always be desirable for ornaental trees, because the change in shape esulting from weevil infestation is not o detrimental and may even be considred aesthetically advantageous.

Ornamental Trees

Spraying. The application of lime sulfur or lead arsenate with calcium caseinate as a spreader has been effective, but the cost is about $1.70 per acre for lime sulfur and $1.45 for lead arsenate including the cost of labor. This cost may be greatly increased by untimely rains. Spraying must be continued year after year to be effective.

Banding leaders. Banding the leaders with a sticky material or raw wool which prevents the weevils attacking them except by direct contact in flight, reduces the rate of weeviling, particularly if the infection is not too severe, but this does not give complete control. However, the cost of banding is about $2.50 per acre and the bands must be renewed yearly.

Collecting the insects. Picking the beetles by hand or jarring them into a net which must be supplemented by hand picking will cost about $2.50 per acre per year. This method is feasible only with small trees the leaders of which can be reached from the ground. Furthermore it is difficult to do it thoroughly.

Forest Trees

Again it should be emphasized that a native parasite is being dealt with, and it is axiomatic that direct control measures should be applied to native parasites only under exceptional conditions. The ultimate method will be to return to an approximation of the original stand composition and secure control by correct silviculture.

It has been the rule, rather than the exception in New England to establish plantations of white pine and then give them no further attention. This can be successful only occasionally. Plantations will have to be properly cared for to assure success. Studies of plantations in the Northeast show that systematic control measures carried on over a period of years result in noticeable improvement in stand quality. In considering costs of control which may seem high or even prohibitive, it must be remembered that without control practically worthless stands will result over extensive areas.

The intensity of weevil damage and the conditions under which it occurs vary widely, so that methods of control in one locality may be relatively valueless elsewhere.

Substitutes for white pine. The most promising substitute for white pine is red pine, (*Pinus resinosa*) which is much less affected by the weevil. However, the establishment of extensive and widespread plantations of pure red pine cannot but lead to serious attacks by insects or fungi in the future, so that the change will merely result in postponing difficulties, not obviating them. At present the European shoot moth seems to be increasing greatly in southern New England on red pine.

Furthermore the available supply of good red pine seed is limited, so that extensive use of this species may ultimately result in poor plantations, either because

of seed from inferior mother trees or because of seed from satisfactory mother trees planted outside its range.

If exotic species are selected to replace white pine, the reactions of such species to native insect and fungous parasites, and to site factors can only be determined by long-time experiments.

White pine growing under proper conditions is a thrifty, aggressive tree yielding high quality wood. It is a remote possibility that a satisfactory substitute will be found for it. There is none in sight now.

Parasites. Other insects which prey on the weevil are undoubtedly important in reducing the severity of the infestation. Such insects are probably now functioning unaided as effectively as can be expected. To attempt satisfactory control by this method, would require the establishment of a large breeding laboratory for the development and liberation of the parasites and predators in enormous numbers. The chances of success are doubtful and furthermore it is a questionable principle to resort to this method for the control of a native insect.

The possibility of finding a fungus which will attack the weevils is remote, particularly in view of the fact that control of parasitic insects by entomogenous fungi has never been more than a transitory success anywhere.

Removal of infested leaders. This method is successful only on good and medium sites, in localities where heavy reinfestation cannot occur from adjacent stands. It may be effective when applied over a large area in a section of heavy infestation but would be futile on isolated small plantations in the same section. Maughan (4) in southern Connecticut finds that plantations of white pine are rarely attacked until four to five years after establishment. Then the weeviled leaders should be removed and burned yearly until the stand closes at from 1 to 14 years of age, making a period about eight years when this work m be carried on. By that time the first feet or the butt log of the tree is form One removal of infested leaders yearly enough if this is delayed until the with ing of new growth is in evidence. total cost of the operation is about $5 per acre.

Exposure. Generally stands on south and eastern exposures are more sever attacked than those on western and nor ern exposures.

Density of stocking. On good sites the stocking is sufficiently dense, a sta can be brought to maturity satisfacto in spite of the weevil. Densities of fr 1,500 to 2,000 trees per acre have b stated to be satisfactory for the purp under some conditions. But in open fie in a locality where weevil infestation usually heavy a stocking of 2,700 tr per acre is necessary during the ea years and full stocking must be ma tained to maturity. Such dense sta seem practical only when they occur n urally, because a spacing of 4 x 4 feet necessary to secure this density in plan tions. Early thinning would doubtless necessary in such dense stands to ma tain a satisfactory growth rate to matur

However, in some areas, stands su ciently dense to preclude consequent damage can be secured at a cost econo cally feasible by filling in natural stan rather than creating new stands on nuded land. Unfortunately, planting nuded land has the greatest appeal to imagination.

Mixed stands. The most effective pr tection against the weevil is to gr white pine in mixed stands, particula in mixture with hardwoods. Groupw mixtures are preferable to stemwise, cause the latter result in injury fr

whipping and too great a suppression of the pine.

If coniferous mixtures are used, a species such as Scotch pine, which grows faster than white pine in the early years must be selected, or a slower growing species such as eastern hemlock must be given several years start of the white pine. Little or no protection is afforded by mixtures unless the associated species are several feet taller than the white pine during the early years.

Every effort should be made to find suitable species for mixture with white pine, not only to reduce weevil injury but to secure a higher quality of timber.

Nurse trees. Where white pine grows as an understory it remains relatively free from weevil attack. For reproduction or plantings under gray birch or other inferior hardwoods, it is the usual practice to release the pine early by removing the hardwoods. Immediately there is a heavy increase in weevil infestation. To avoid injury, sufficient cover must be maintained over the pine to protect it from the insect until the first 16-foot log is formed at least, but the cover must not be so dense as to seriously suppress the pine. This will reduce the growth rate of the pine, but the stand quality will be much improved.

Reproduction method. The shelterwood system should be applied to pure stands on lighter soils. This method usually assures regeneration sufficiently dense to permit the final removal of the mature trees while the reproduction is small, dependence then being placed on the density of the reproduction to form a new stand relatively free from weevil injury. However, if the reproduction is rather light, some of the old stock will have to be maintained until the understory trees have formed a 16-foot log at least.

Probably the strip method can also be used with success.

Possible New Methods of Control

Attrahents. Although the possibilities of using attrahents to facilitate trapping the weevils have not yet been extensively investigated, experience with this method for other insects such as the Japanese beetle does not hold out much hope for successful control of the white pine weevil in this manner.

Ground litter and cover. Determination of the effect of different types of ground litter and plant growth other than pine in relation to hibernation of the weevil might show that certain types were distinctly unfavorable to hibernation. However, modification of litter and plant cover would have to be induced by modification of stand composition, so that here again the desirability of mixed stands would probably be indicated.

Birds and rodents. Birds and rodents have generally been assumed to aid in reducing the weevil, both in the larval and adult stages. There is considerable doubt whether birds exercise any beneficial influence as they may destroy as many parasites as weevils and the evidence to date is not conclusive. In any event, modifying bird and rodent population cannot be expected to reduce damage to a point of no economic importance if other measures are neglected.

Reclaiming weeviled plantations. Probably the most urgent problem now is the extensive plantations of young white pine already severely damaged. Maughan (4) points out that in infested stands, the intermediate trees which frequently escape injury can be left to fill the gaps caused by cutting the seriously injured dominants and co-dominants. Cline and MacAloney (1) have developed a method which gives promise of salvaging severely damaged stands. The weeviled dominant and co-dominant trees are girdled, thus favoring the uninjured or slightly injured codominant and intermediate individuals, enough of which can usually be found even in

severely damaged stands to assure a reasonable stocking of trees with well-formed butt logs at maturity. The increased value of the final crop should greatly exceed the cost of girdling, particularly if this operation is combined with pruning the butt log on the remaining trees.

This method seems to be the only feasible one for reclaiming weeviled stands and should be tried in various localities. However the creation of a large number of dead trees in a stand may result in unforseen damage from insects and fungi, but if such injury did occur it is doubtful if the final effect on the stand would be nearly as serious as uncontrolled weeviling.

Conclusion

No quick and simple panacea for the white pine weevil will be found. For the past 10 years the results of different investigators working in different localities in the white pine region of New England, New York and the Lake States all point to the same methods of control. The methods are to grow white pine on good sites and in mixture, preferably with hardwoods. If pure stands are grown they will either have to be very dense at the time of establishment or protected by nurse trees sufficiently dense to largely eliminate weevil injury and at the same time permit white pine to make satisfactory growth, considering that a slower grown stand of straight trees is ultimately far more valuable than a more rapidly grown stand of misshapen individuals yielding a low grade product. The weevil epidemic has been created by cumulative mistreatment of the forests in the white pine region of New England since colonial days and by the injudicious establishment of pure plantations and their subsequent neglect. Ultimate control of the weevil will have to come through the application of correct silviculture to white pine.

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CHANGE IN FORM OF RED SPRUCE AFTER LOGGING AND OF NORTHERN WHITE PINE AFTER THINNING

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Change in form of trees left after logging is shown to depend upon the original character of the trees themselves. There will be no significant change in average form quotient unless the residual trees vary consistently above or below the general average at time of cutting. The amount of variation in form quotients of residual trees decreases for a number of years after partial cutting.

GROWTH OF residual trees on cut-over lands has traditionally been estimated from measurement of growth in breast high diameter and height of the individual trees. Volume tables prepared from measurement of trees in the uncut or virgin stands have been used for computing the content of the trees without consideration as to whether the average content of trees of a given diameter and height might be significantly different in cut-over or thinned stands from what it is in uncut stands.

Cutting generally results in stimulation of growth in diameter at the breast high point. The question has frequently been raised as to whether this stimulation of growth is confined to the lower portions of the stem or whether the growth in the upper portions of the stem is increased proportionally. It has been postulated that, since open grown trees generally have more rapid taper than those grown in closed stands, trees left after a cutting would tend to put on most of their growth at the base in order to adapt themselves to withstand the greater exposure to wind, and thus would tend to approach the typically lower form quotient of open grown stands. If this were true, volume tables based on trees from uncut stands would overestimate the content of trees on cut-over land.

Similar considerations also arise in the case of even-aged stands which have been heavily thinned, or in regard to the growth of seed trees left isolated for a period of years for the regeneration of the stand. In each case trees which have grown in a closed stand are subjected to exposure and given the benefit of increased growing space. In the case of the residual stand left after a selective cutting of merchantable material, the trees left are likely to include a large proportion of the smaller sizes or of the intermediate or suppressed crown classes, whereas in the case of thinnings the trees of better development, mostly in the dominant and codominant crown classes, are left. Seed trees will also be selected from among the trees of better development with full crowns, but conditions will differ from those in thinned stands in that the trees are left isolated whereas in thinnings a more or less continuous canopy is maintained.

Review of Literature

These are not many references in the literature to this problem. Flury (1) in 1903 in reporting on the results of four grades of thinning on 342 plots of spruce and beech in Germany, stated that the form-height is not reduced by thinning but is in fact larger in Grade C than in Grade A or B thinnings, and also that the diameter at the middle of the merchantable length is as favorably affected by thinning as the breast high diameter.

Kunze in 1913 (3) also made observations on change in form when reporting on the effect of three grades of thinning

made 50 years earlier in a stand of Scotch pine in Saxony. He stated that he could find no indication of a deterioration in form due to heavy thinning and in fact he reported the form below the crown relatively better on heavily thinned plots. Stem analyses of sample trees confirmed this favorable effect of heavy thinning on taper.

In 1917 and 1918 Weidman (6, 7) opened the question in this country in connection with studies of growth on cut-over western yellow pine lands in Oregon. An analysis of a few trees in the first year of this study showed a striking decrease in the rate of accelerated growth with increase in height on the stem. Whereas growth at breast height on a 15-year-old cutting had been increased 235 per cent, growth at 44 feet from the ground was only 123 per cent greater than before cutting. Subsequently reconstruction by full stem analyses of additional trees from a stand cut over 22 years previously showed similar but less marked differences in percentage increase in growth at varying heights.

Krauch (2) gave some consideration to the possible effect of unequal distribution of growth upon his calculations of increment on cut-over western yellow pine stands in the Southwest and found that in a period of 25 years the growth after cutting was 19 per cent less at a point 18 feet above ground than at breast height, while prior to the cutting the growth had only been 5 per cent less at this point.

Behre and Wheaton gathered some data from increment borings at intervals up the stems on western white pine on land cut over about fifteen years previously. (Manuscript report, 1924, at University of Idaho.) This material indicated a fairly definite decrease in form quotient after logging on the average, but was hardly sufficient to draw general conclusions as to the importance of this reduction.

More recently in Sweden Nyblom (5) studied the change in form of Scotch pin trees which had been left as seed trees cuttings ten to twelve years earlier ar found that trees with form quotients le than 70 increased while those with for quotients over 75 decreased in form. Th average change in form quotient was fro 2 to 3 units, three stands showing an i crease and one a decrease.

In order to settle the doubt whic Weidman's work had created as to th character of growth in western yello pine, Meyer (4) analyzed from increme borings at 16 feet intervals the stems 174 trees which had been released 20 40 years in the past in 10 different stand He found that the range of form quotien had been very materially decreased fo lowing the cutting, and that all had ten ed to approach a common mean. No si nificant change in the average form qu tient was indicated in any of the stand This seems to be in agreement with th recent work in Sweden.

From these notes it will be seen th the literature is not very extensive an that the findings prior to 1925 appear sufficiently at variance to leave conside able uncertainty as to what the facts wer The writer, accordingly, undertook to s up an experiment in 1924 to throw mo light on the problem in connection wi the selective cutting of a stand of spru and northern hardwoods on the Whi Mountain National Forest in New Ham shire. The results are essentially th same as those reported by Nyblom an Meyer.

DESCRIPTION AND HISTORY OF STAND

The stand in which this study was mad is typical of the yellow birch-red spru type of northern New England. It is l cated on the southeastern slope of Cher Mountain at an elevation of about 2,00 feet.

A cutting of softwood had been mad in this stand about 50 years prior to th

ime of the initial measurement in 1924. udging from general knowledge of operaions in that period and from the evidence of old stumps on the ground, the earlier utting removed only the spruce of size uitable for high grade sawlogs. This left he hardwoods and balsam fir untouched and in addition left a considerable numer of small to medium sized spruce. That he residual conifers were stimulated in growth by this early cutting is distinctly shown by increment borings. We may conclude, therefore, that the cutting was sufficiently heavy to subject the remaining trees to a change of conditions which might be reflected in change of form.

In 1924 this stand scaled about 13,000 board feet per acre which was about equally divided between hardwoods, chiefly yellow birch, and conifers. During the winter of 1924-1925 a selective cutting was made in this stand in which it was hoped to save thrifty spruce and fir for future growth. The residual stand of 3,800 board feet per acre was further reduced to about half that amount by windthrow in the course of a few years. Careful analyses were made of 41 residual red spruce trees at the time of cutting and 15 which remained in 1930 were measured a second time.

Study of Effect of Past Cutting From Increment Borings

Complete records for the 50-year period since the previous cutting were available for 35 trees, the remainder having been too small in 1875 to contribute to the record. The average form quotient of the 35 trees having complete records showed a decline of two form quotient units in the first decade following cutting, no change in the second decade, and a gradual increase in the next three decades, so that the average form quotient in 1925 was slightly above that of 1875.

It is possible that the true trend of the average change in form might be concealed by the fact that the data from these 35 trees would include trees of all sizes at the beginning of the period, but only trees considerably over four inches d. b. h. at the end. Since for practical purposes the average form quotient of the stand at any period would be determined on trees over four inches d. b. h., the average form quotient at each decade was recomputed on this basis. The decline in average form quotient following cutting is now more acute and continues through two decades, totaling about five units.[1] The rise, which follows a decade of practically no change, is less marked, totaling only about 1.5 units.

In considering the effect of changes in form quotient upon the accuracy of volume estimates it should be remembered that each unit of form quotitnt is equivalent to approximately 1.5 per cent of total cubic volume.

When the trees are sorted according to their form quotients at the time of cutting in 1875 (Figure 1), those with high form quotients show a steady decline and those with extremely low form quotients a steady increase, while the intermediate classes show a decline at first followed by a slow increase. This results in a sharp reduction in the spread of form quotients in the first three decades after cutting, the standard deviation of form quotients dropping from 8.86 units to 4.48 units between 1875 and 1905.

An attempt was made by the method of graphical multiple correlation to see if the change in form in the first decade following cutting was associated with diameter and height as well as form quotient, these being the only other factors for which data could be set up. Neither diameter nor height appears to have any influence on the change in form. The linear

[1]A unit form quotient is one per cent of the normal diameter at breast height.

coefficient of correlation between change in form in the first decade following logging and form quotient was—0.727.

Since trees in an understory would hardly be affected by a cutting in the same way as trees of the main canopy, additional light on the subject may be added by segregating the trees on this basis. The trees were about equally divided between the understory and main canopy in 1924. Those in the understory averaged about 10 units lower in form quotient in 1875 than the trees in the main canopy. The latter dropped a few points in the first two decades after cutting and then remained practically constant, whereas the understory dropped only slightly during the first decade and then climbed steadily to within a few points of the main stand.

Of the trees for which full records are available only six were above seven inches in normal diameter at breast height at the time of cutting in 1875. The average form quotient of these trees has shown practically no fluctuation. They have maintained an average close to form class 70 which other studies by the author indicate is to be expected in stands of spruce and hardwoods which have been heavily culled. Form class 70 is also the common mean toward which all the groups have approached.

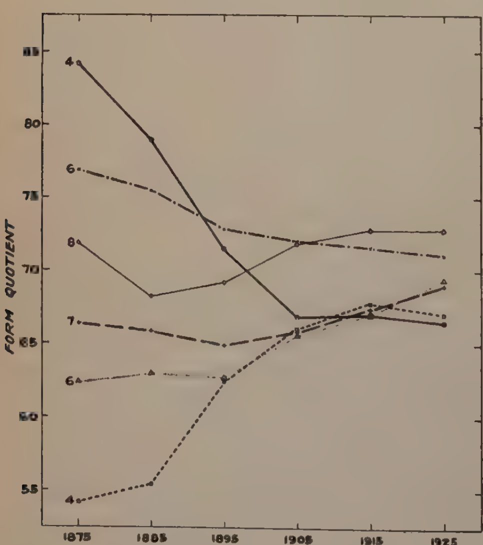

Fig. 1.—Change in form after logging. By form classes.

Change in Form Following Cutting of 1925

The possibility of error from the interpolation of tapers from increment borings is completely eliminated in the data showing the development since the cutting of 1925.

The average form quotient of the fifteen trees available for remeasurement in 1930 showed no significant change, the actual difference being an increase of about 0.8 units. During this period of almost six growing seasons, the standard deviation of the form quotients decreased from 3.99 units to 3.24 units, thus indicating the same tendency for the individual trees to approach a common mean which was shown by the increment borings to have followed the previous cutting in 1875.

The change in form of the individual trees was studied in relation to form quotient at time of cutting, diameter, height and crown per cent, by graphical multiple correlation. An index of multiple correlation of from 0.97 to 0.98 can be obtained in this way if one erratic tree is discarded, so it is obvious that the individual changes are closely associated with these factors. Original form quotient apparently has the greatest effect, the lowest form quotients increasing much more than the higher. Diameter and height have about equal weight but they work in opposite directions and therefore offset each other. The relative length of crown has only about half of the effect of form quotient. Rate of growth in diameter seems to have no correlation with change in form. The correlation index obtained from form quotient and crown per cent is 0.96, while from form quotient alone it is about 0.885.

Trees in the dominant and codominant crown classes which constituted the main canopy show a much smaller increase in form quotient than do those in the intermediate and suppressed classes of the understory.

The action of all the individual factors is in agreement with the results of the earlier cutting as shown by analysis of the increment borings. The fact that the average form quotient has increased slightly since the 1925 cutting, whereas a more significant decrease followed the cutting of 1875, is consistent with the detailed findings, because the trees which survived after the cutting of 1925 had an average form quotient lower than the indicated ultimate value of 70, while those left in 1875 averaged several points above this median.

Conclusions With Respect to Selective Cutting of Red Spruce

In stands of the yellow birch-red spruce type, spruce trees left after a partial cutting tend to approach a common mean form quotient. The dispersion of form quotients in the stand will be less for a number of years after cutting than before, equilibrium being reached after two or three decades. The change in form of the individual trees is closely correlated with their form quotients at time of cutting, and may be very accurately predicted from form quotient and crown per cent. Whether or not any significant change in the average will take place, therefore, depends largely on the character of the residual stand. If the residual stand average below a median value of about FQ 70, it may be expected to increase its form quotient after cutting, while if its form quotient at time of cutting is above 70, a decline toward this figure may be expected. It is unlikely that the change in average form will exceed 5 units of form quotient, which is equivalent to about 7.5 per cent of volume.

Supplementary Notes on Thinnings in Northern White Pine

Full stem analyses of thirty-four northern white pine trees, removed in 1925 and 1930 from a stand at Keene, New Hampshire, which had been the subject of thinning experiments since 1905 were made available to the author by Prof. R. C. Hawley, of the Yale School of Forestry. The even-aged stand from which these trees were cut was heavily thinned in 1905, when it was 35 years old. It was thinned again in 1915, 1920, and 1925, each time reducing the basal area to approximately 100 square feet per acre. In each operation thinning was from below, removing the inferior trees and favoring those of best development. The stand, its treatment and growth are fully described by Hawley in Bulletin 20 of the Yale School of Forestry.

The standard deviation of the form quotients of these trees was 7.25 units in 1905 but only 3.83 units in 1925. Although this is consistent with the findings reported for red spruce and western yellow pine, it is not convincing in itself, because repeated thinning would have tended to reduce the extent of variation in the remaining stand. Furthermore, the trees selected had all reached the point where their removal in thinning was indicated, whereas they doubtless were more representative of the stand as a whole at the time of first treatment. Only one of them was classed as dominant in 1925, although many of them had been so graded in 1905.

Trees of all form classes have tended to converge at about FQ 74, which is again in conformity with the behavior of the other species studied. There has been, however, a distinct increase of almost five units of form quotient in the average of all the 34 trees. The significance of this increase is perhaps open to question as applied to the entire stand since, as already explained, it is based on the devel-

opment of a class of trees which had gradually fallen behind in the struggle for dominance. However, this is in agreement with the early German observations on the effect of thinning in even-aged stands. But since young even-aged stands normally do show an increase of form quotient with increasing age, it is impossible to say, without analyzing trees from the unthinned check plot, in what way the thinning has influenced this change of form.

General Conclusions

In general it appears that an increase in average form quotient may be expected in young even-aged stands which have been heavily thinned from below, whereas selective cutting of merchantable material from many-aged stands leads to a subsequent decline in average form quotient. Only under extreme conditions, however, will the effect on volume computations be as much as 7 per cent.

In thinnings, dominant trees of good crown development are favored and this class of trees will run below the average in form quotient. On the other hand selective cutting of merchantable material leaves the smaller trees usually from the lower crown classes and these will be above the average in form quotient. The difference in response appears, therefore, to be consistent with the general principle established by this and other investigations, namely, that change in form after cutting is closely correlated with form quotient at the time of cutting. The final explanation of this phenomenon in terms of food supply or the mechanics of tr[illegible] growth is, however, not so clear.

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[2]The writer is indebted to Dr. Walter H. Meyer for abstracts of references to European literatu[illegible] here cited.

TREE PHYSIOLOGY

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In recent years there has been an increasing interest in the physiology of trees by those in charge of American forestry research policies and by a number of silvicultural investigators. In describing what is perhaps the first course in tree physiology in this country the author also indicates how fundamental this branch of pure science is to the forester.

THE IMPORTANCE and the obvious requirement for a greater emphasis upon investigative programs in sil-iculture involving the physiology of trees as been very ably set forth by E. H. lapp in *A National Program of Forest 'esearch,* 1926 and again by I. W. Bailey nd H. A. Spoehr in *The Role of Re-earch in the Development of Forestry in 'orth America,* 1929. The methods to e employed in attempting to solve the roblems which this increased interest in ie vital activities of the tree and of the orest present are more obscure. One ethod of attack upon this phase of the roblem has been the development at ale University of a course in tree phys-ology designed specifically for students f forestry. This course, given for the rst time in 1929, was developed as a atural response to a growing interest of inior and senior forestry students as well graduate forestry students in the regu-r plant physiology courses of the de-artment of botany.

At the present time an increasing im-ortance is being attached to work in rest entomology, forest pathology and rest soils. While tree physiology has uch in common with each of these ecialized phases of forestry yet its ob-ctives and applications are not so well derstood in America as they might be. Europe, the work of Hartig, Büsgen, ünch, Doyle and others in a variety of ases of forest tree physiology has devel-ed a substantial background of inves-gative work and a general acceptance of e significance of physiology and the physiological method of experimentation. A similar attitude is necessary in America if we are to successfully cope with the many problems associated with the life of the forest tree under our conditions. While an understanding of the principles of physiology in relation to tree life and the complex life of the forest by the forest practitioner may have been considered of minor importance in the past it is, I believe, safe to predict that this science will become increasingly important if for no other reason than to make possible the intelligent interpretation and application of the results and recommendations accruing from the efforts of research workers in scientific forestry of the future.

In the development of an organized course in tree physiology it was recognized that one of the chief difficulties was an instructive presentation to students with varied training in botany, chemistry, physics, and forestry as well as experience or lack of experience in research methods. This feature of a rather heterogeneous student body has required considerable thought and is not yet altogether solved. Sufficient character, however, has been introduced into this departure from a regular course in plant physiology to justify amply its objectives. The basic thesis of the course was to explain in a stimulating manner the chemistry and physics of trees and tree parts and the functions and processes of the various organs as well as the relation of the tree to its environment so that each student would secure information of value and in so far as possible impart an urge to each student to seek

further into the subject according to his capacity and interests.

It has been found that a natural approach to the subject matter of tree physiology can be attained by a discussion of the tree habit giving due emphasis to those phases of tree structure and function that are similar to those of herbaceous plant life and to those aspects in which they differ. A discourse on the capacity of trees to form lignified cell walls leads to a discussion of cell wall characteristics which in turn gives an opportunity to consider the colloidal nature of protoplasm. In the realm of cellular physiology, imbibition, osmosis and permeability are the chief phases considered. A description of the hydrostatic system of the entire tree is then presented with the details of water conduction, reversible fluctuations in trunk diameter, root and exudation pressures, water loss and the gaseous system of the trunk.

Since the early portion of the course coincides with the season of freezing temperatures in New Haven, it has been found opportune to introduce a discourse on the relation of trees to cold temperatures, theories of hardiness and cold resistance and frost injuries. For a similar reason, the physiology of sap flow in the sugar maple tree is considered at a later date when evidence of such exudation is to be observed in wounded trees growing in the vicinity of New Haven.

The subject of the mineral nutrition of trees is considered in both its theoretical and practical phases, the latter, in both nursery and shade tree fertilization. The relation of nitrogen to tree development is taken up in part at this point and again in the consideration of protein formation.

Photosynthesis, the outstanding synthetic process of all plants is approached from morphological and chemical viewpoints with due emphasis upon the external and internal influencing factors. The biochemistry of the products of photo-
synthesis, the carbohydrates, leads to d
cussions of fats and proteins with re
tion to their possible modes of origi
special properties and general metabo
features. In metabolism, enzyme acti
is emphasized as well as the part play
by enzymes in decay. The translocati
of organic foods brings in the season
picture of reserve foods, also the diff
ences found between the kinds of fo
stored by various tree species. The en
gy relations involved in respiration a
dealt with in a generalized manner.

Upon growth, a subject in which t
literature of forestry is rich, the disc
sion has been limited to a considerati
of such factors as water supply, the lig
relation, and the influence of toxic age
in the soil and in the air. The physiolo
of seed germination and dormancy ha
been considered the most essential phas
of reproduction for emphasis.

While the lecture portion of the cour
allows of the presentation of a relative
large mass of organized information up
the living functions of trees it is in t
laboratory, the greenhouse and field th
the characteristic experimental attitude
physiologists can be best displayed. T
practical side of the course has be
found unusually well fitted for taki
into account the varied preparation of t
students. For those who have not p
viously taken courses in plant physiolo
a series of experiments following the le
ture topics are required. The studen
who have had previous training in
physiology laboratory are excused fro
the repetition of those experiments
techniques with which they are famili
and are encouraged to substitute othe
of a more advanced character or enga
in brief experimental projects in t
phases of tree life in which they are mo
interested. Since the classes so far ha
had one-half or more of the students wi
previous training in plant physiolo
there has been a very considerable amou
of project work done and with most i

resting results. Examples of this type work are: studies of the influence of ght intensity upon herbaceous seedlings d potted trees, the influence of various alities of light on similar material, udies of the photoperiod on young trees, e stimulation of dormant trees and tree eds with chemicals, the influence of soil oisture on tree growth, the relation of rious forms of nitrogen to tree growth, ecific conductivity of the branches of rious trees, the temperatures of the rk and wood of trees during the winter riod, the conditions existing in the leaf lls of conifer needles during the winter spring transition period and, in one se, the determination of the electro- otive force of a white pine tree. This st of special projects chosen by the more lvanced students during the past three ars is by no means complete but it does ve a sufficient cross section to convey idea of the variety of physiological estions American students of forestry e interested in or can be encouraged to think about. More important, is the actual demonstration that many physiological problems connected with forest trees are subject to experimental attack within limited time periods and that frequently young trees under greenhouse conditions during the winter period are as responsive in their vegetative growth phases as many herbaceous plants under similar conditions. In the laboratory the application of simple chemical tests and physical principles brings forth a confidence on the part of students to which such methods and techniques were previously more or less foreign so that they frequently make adaptations of the principles to problems they may have conjectured about for a long time. This awakening and culturing of an alert, experimental attitude is in my opinion one of the most important contributions a science course can instill in a student. This feature applies to the future practitioner in forestry as well as to the future investigator in scientific forestry.

The word *forest* is derived from *foris stare,* which doth signify to stand or be abroad; and *forestarius* is he that hath the charge of all things that are abroad, and neither domestical nor demean; wherefor *foresta* in old times did extend unto woods, wastes, and waters, and did contain not only *vert* and venison, but also minerals, and maritinal revenues.

From *A collection of Curious Discourses written by eminent Antiquaries upon several Heads in our English Antiquities.* Oxford, 1720.

CONVERTING FACTORS FOR SOME STACKED CORDS

By G. LUTHER SCHNUR

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On an area in the beech-birch-maple type in Pennsylvania the amount of solid wood per stack cord was found to be approximately the same for trees of all diameters, when random piling was used and all sticks over 8 inches in diameter were split. The finding differs from that of other investigators, and the author discusses the reason for it.

THE PURPOSE of the investigation with which this report deals was to determine factors for converting the solid cubic-foot contents of trees, as generally obtained from volume tables, into stacked cords. A standard cord is a stack of wood 8 feet long and 4 feet high, composed of sticks 4 feet long, and has a volume, including air-space, of 128 cubic feet. In this study the sticks used were 52 inches long, making a cord of approximately 138.5 cubic feet, stacked measure.

The stacked cord unit is used extensively in the fire wood, chemical wood, and pulpwood industries as a basis for stumpage estimates, payment for woods operations, and in some cases for sale of the product. On the other hand mill operations in the chemical wood and pulp industries, and measurements of growth and yield among research foresters, are often based upon cubic contents of solid wood. Because these two standards are widely used, converting factors from one to the other are essential.

Previous Work

The amount of solid wood in stacked piles has been a subject of study for a great many years. Graves states (2) that the problem was studied in Germany as early as 1765 but that reliable figures were not obtained until 1879, when Bauer published the results of an exhaustive investigation, and 1881, when Von Senkendorf arrived at practically the same sults in an independent investigation Austria. These studies showed an crease of solid wood content in the u pile with an increase in diameter of t sticks; Zon (5) obtained the same resu in the United States in 1903.

Up to this time it seems that the rati between solid and stacked wood conte had been figured entirely on a stick bas factors being secured for converting t solid contents of sticks of different s groups into stacked cords. Frothingha (1) went one step further in his study second-growth hardwoods in Connectic by obtaining tree converting factors. Af securing stick factors by stacking stic of the same diameter class separately a getting the ratio between the solid a stacked contents for the various diamet classes, he used the converting factor the average stick in any tree as the co verting factor for that tree; in oth words if the diameter of the average sti in a 10-inch tree is 7 inches, then t stick converting factor for a 7-inch sti is also the tree converting factor for 10-inch tree, according to Frothingha The Southern Forest Experiment Stati (6) made another step forward by stac ing wood from trees of the same d.b class in separate piles and comparing t solid and stacked volumes for the vario classes. In both of these cases the amou of solid wood in a cord increased wi an increase in tree diameter.

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[1]Maintained at Philadelphia, Pennsylvania, by the U. S. Forest Service, in coöperation with University of Pennsylvania.

The Present Study

The previous American studies, it should e noticed, were based upon selective iling either of sticks or of trees. On ommercial cordwood operations the trees nd sticks are piled at random so that rees of several diameter classes are found n the same pile. Because the cord is a init of purely commercial use, having ittle value in scientific work, converting actors obtained under artificial or non-ommercial conditions would appear to be vorth very little to anyone. The trees ısed in the present study were therefore piled at random. The only departure rom commercial practice was that no ree was divided between two or more piles. Each pile contained the merchant-ible portion of a number of whole trees. This field procedure can be used when he least squares method is used in solv-ng for the factors.

In 1928 the Experiment Station was nvited by the Supervisor of the Allegheny National Forest to take charge of a con-erting factor study which the Forest had entatively planned.

The area selected for study is located n the Allegheny Plateau in the western oart of McKean County, Pennsylvania, on he Day Chemical Company's land near Westline. It supports a mixture of sec-ond-growth northern hardwoods in the proportions, by basal area, indicated in Table 1.

For this study 903 trees were felled and ut into 52-inch lengths to a diameter imit of 2 inches in the top. The follow-ng measurements were taken on each ree: stump height, diameter at each sec-ion, length of each section, and length of he top above the merchantable limit. All diameters were taken with a tape to the nearest tenth of an inch, and all lengths measured to the nearest tenth of a foot. The sticks were piled, the stacked content of each pile was measured, and a record of the trees in each pile was made. The trees varied in size from 2 to 22 inches in diameter breast high, and the stacks varied between 0.5 and 4.25 cords. All sticks over 8 inches in diameter were split. A total of 30 piles aggregating about 53 cords was tallied. The piles were 4 feet high[2] in all cases, but varied in length by 2-foot classes which made 0.25 of a cord the minimum difference in size of the pile.

The volume of each stick was computed by multiplying the cross-section area of the stick, at the point of average diameter by the length.[3] Merchantable tree volumes were obtained by totaling the stick volumes. Solid wood contents by tree diameter classes were totaled for each pile. Three-inch d.b.h. classes were used and the mate-rial was tabulated as in Table 1. These tabulations represent a series of 30 ob-

Table 1

SPECIES DISTRIBUTION OF STUDY AREA

Species[1]	Per cent basal area at breast height
Red maple	26.0
Sugar maple	23.4
Beech	18.6
Black cherry	16.8
Pin cherry	11.3
Sweet birch	1.9
Cucumber magnolia	.7
White ash	.5
Yellow birch	.4
Largetooth aspen	.3
Dogwood	.1

[1]Nomenclature by G. B. Sudworth, U. S. Dept. Agri. Misc. Circ. 92.

[2]The piles were made about 4′ 4″ high to allow for shrinkage and settling, as is customary for the egion, but were recorded as 4′ high.

[3]All volumes dealt with in this paper include the bark.

servation equations of the following type:

$$V_0 = V_1 f_1 + V_2 f_2 \ldots\ldots$$

Where V_0 = The stacked volume of the pile in cubic feet.

$V_1, V_2, \ldots$ = The solid volumes of successive 3-inch d.b.h. classes.

$f_1, f_2, \ldots\ldots$ = The converting factors for successive d.b.h. classes.

From these equations a set of normal equations was formed, and solved by the least squares method, using the Doolittle arrangement as set forth by Mills (3). The size of the job may be judged from the fact that for reasons elsewhere explained (4) some of the computations had to be carried out to 32 significa decimal places.

Column (3), Table 3, shows the actu factors obtained from the solution of t normal equations. The content of a chee ical-wood cord, 138.5 cubic feet, w successively divided by each of these fa tors to obtain the number of cubic fe per stacked cord appearing in colum (4).

The standard cord values (column Table 3) were obtained from the sar factors by dividing 128 cubic feet, th stacked content of a standard cord, b each factor.

TABLE 2

TABULATIONS FOR TREE CORRELATION

Pile number	Stacked volume Cu. ft. V_0	Solid volume—cubic feet by tree d.b.h. classes—inches							
		0-2.9 V_1	3.0-5.9 V_2	6.0-8.9 V_3	9.0-11.9 V_4	12.0-14.9 V_5	15.0-17.9 V_6	18.0-20.9 V_7	21.0-23 V_8
1	69.25	.880	14.546	12.609	14.533				
2	69.25	4.716	23.855	15.361					
3	242.38	2.039	42.778	22.138	51.795	31.135			
4	242.38	3.634	39.483	40.858	52.864				
5	242.38	2.964	33.146	35.196	14.501	40.881			
6	242.38	4.527	28.766	43.523	29.137	28.973			
7	242.38	6.125	29.258	61.766	37.680				
8	138.50	5.962	15.071	21.975	27.423				
9	103.88	.605	22.108	43.670					
10	103.88	3.214	25.265	30.061					
11	277.00	5.686	36.664	45.438		64.809			
12	277.00	4.984	20.527	68.797	15.832	44.553			
13	311.62	3.033	22.837	49.787	13.395	34.418		48.652	
14	346.25	5.005	9.628	38.864	65.252	75.560			
15	277.00	6.859	36.603	62.440	14.430	32.543			
16	207.75	3.665	33.152	29.893	40.502				
17	207.75	4.602	8.259	79.132	17.824				
18	277.00	4.779	47.342	103.569					
19	103.88	2.014	17.982	23.087	21.300				
20	588.62	.382	22.720	16.607	154.127	73.431	77.992		
21	277.00	4.064	17.396	38.282	50.975	34.941			
22	415.50	6.486	78.448	61.973	80.960				
23	207.75	7.785	26.860	30.177	17.731	31.045			
24	277.00	12.449	27.470	56.942	15.410		44.067		
25	207.75	4.286	16.972	15.400	39.230		47.904		
26	277.00	4.840	14.123	55.191	88.685				
27	346.25	3.781	43.004	19.637	23.033				110.421
28	346.25	3.319	38.949	37.505		60.141	65.889		
29	277.00	3.989	24.867	31.934	59.585		56.637		
30	138.50	4.868	16.228	16.269	47.333				
Total	7,340.53	131.542	834.307	1,208.081	993.537	552.430	292.489	48.652	110.421

Figure 1-A shows graphically the computed converting factor for each 3-inch diameter class, weighted by volume. The plotted points are connected by broken lines and a horizontal straight line is drawn through the average factor for the whole mass of data, viz., 1.76. From inspection it appears that this is the line of best fit for all the points except the first, that for the 0-to-3-inch class.

The 0-to-3-inch point is at the extreme lower end of the data, and was suspected of being merely an erratic value. In order to test this, each observation equation in Table 2 was combined so as to give only two independent variables, one for the 0-to-3-inch class, and one for all classes above 3 inches. The same process of solution was used as for the main problem. The factors obtained were 3.41 for the 0-to-3-inch class, and 1.71 for all other classes. This indicates that the difference in the 0-to-3-inch class is real rather than accidental.

Figure 1-B is the graphic representation of the values in columns 4 and 5, Table 3. A mean of 73 solid cubic feet to the standard cord is obtained by using all of the data in column 5, weighting each value, using the weights recorded in Figure 1-A. This average applies to all d.b.h. classes and is represented by the horizontal broken line in Figure 1-B. Two of the 8 average points deviate considerably from this line. The 15-to-18-inch point is erratic but does not define an upward trend because the next two points are very close to the mean line. This is more clearly emphasized by the original factors in Figure 1-A. As indicated in the discussion of Figure 1-A, the 0-to-3-inch point represents a real divergence from the mean. The factors 3.41 and 1.71, derived in the previous paragraph, give 38 and 75 cubic feet per standard cord, respectively. The use of 2 independent variables instead of 8 lowers the 0-to-3-inch value from 43 to 38 and raises the average value of the remaining 7 from 74 to 75. Practically, however, this is of little consequence, because very few trees below 3 inches are used for cordwood, and their volume compared to that of the whole material is very small.

The conclusion here is, that one converting factor may be used for all d.b.h. classes. This is 73±5 cubic feet of solid wood to the standard cord or 79±6 cubic feet to the chemical-wood cord, the actual mean values and their standard errors computed from all of the data.

Table 3

COMPUTED TREE CONVERTING FACTORS

(1) Factor symbol	(2) D. b. h. class inches	(3) Factor[1]	(4) Cu. ft. per chemical-wood stacked cord	(5) Cu. ft. per standard stacked cord
f_1	0— 2.9	2.96	47	43
f_2	3.0— 5.9	1.69	82	76
f_3	6.0— 8.9	1.77	78	72
f_4	9.0—11.9	1.72	81	74
f_5	12.0—14.9	1.85	75	69
f_6	15.0—17.9	1.41	98	91
f_7	18.0—20.9	1.83	76	70
f_8	21.0—23.9	1.70	81	75
Weighted averages	0—23.9	1.76	79	73

[1]Ratio of stacked to solid volume.

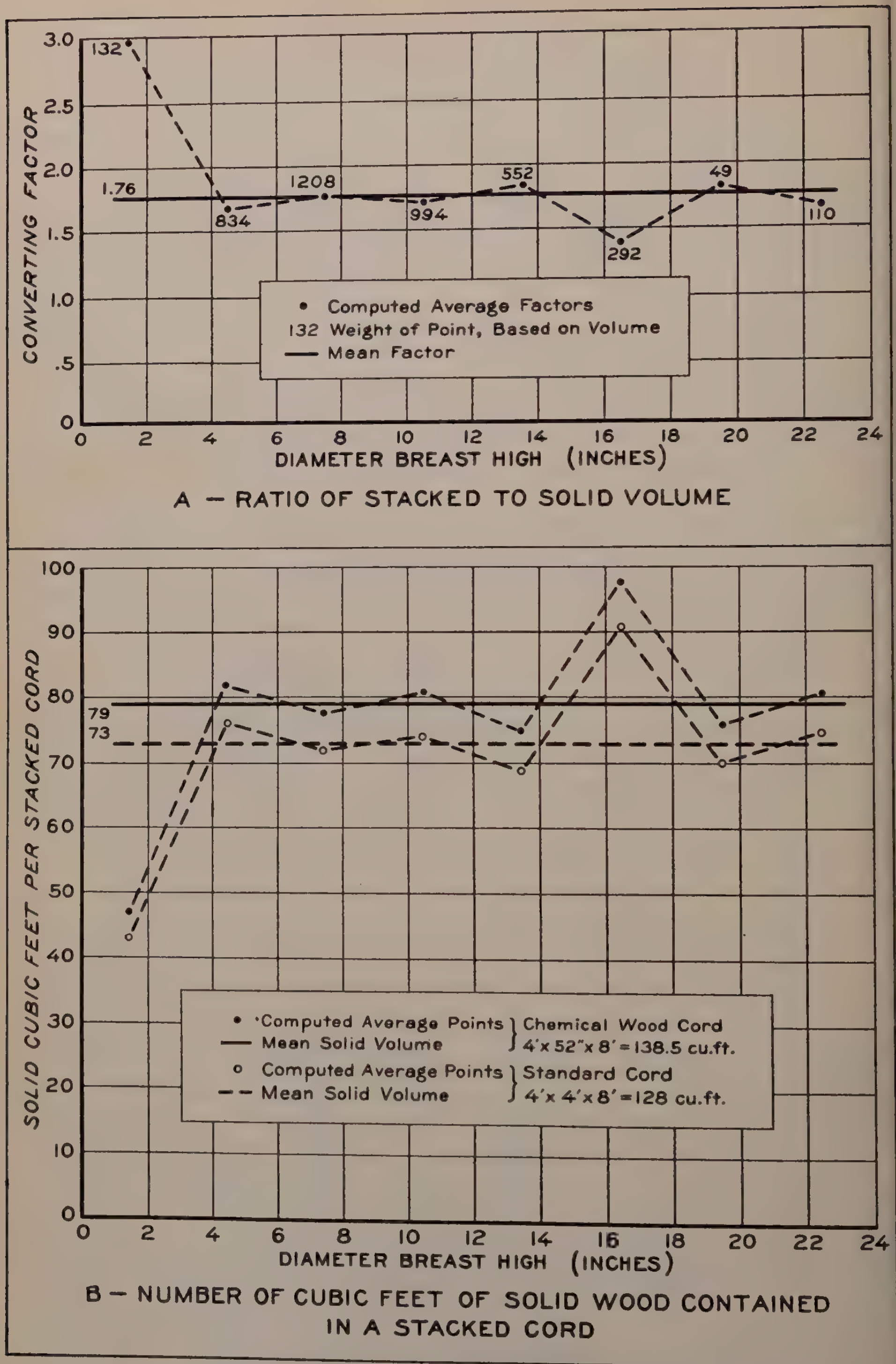

Fig. 1.—Relation between stacked and solid volume.

Discussion

This conclusion is quite different from t reached by previous American inves- itors, and some justification on theo- ical grounds is necessary.

First, it must be remembered that we comparing trees, not sticks; second, t all sticks over 8 inches in diameter split; and finally, that random piling been used. In Figure 2 is represented, grammatically, the average tree in each nch diameter class.

Through the 2-inch and 8-inch diameter ints lines have been drawn. All wood ove the 2-inch line is unmerchantable d therefore not considered. All wood ow the 8-inch line has been split into pieces of roughly similar diameter and straightness, which may be expected to stack with about the same amount of air space. The larger the tree the more gnarled and crooked, but shorter, is the portion above the 8-inch line; the decreasing percentage of small sticks per tree in the larger trees tends to offset the looseness of piling resulting from this, as does the decreasing proportion of round (unsplit) wood. The total volume of material from small trees is necessarily small, and a variation in its converting factor from the average for larger trees has little effect on the factor for a large volume of wood obtained from trees ranging in diameter from 2 to 22 inches.

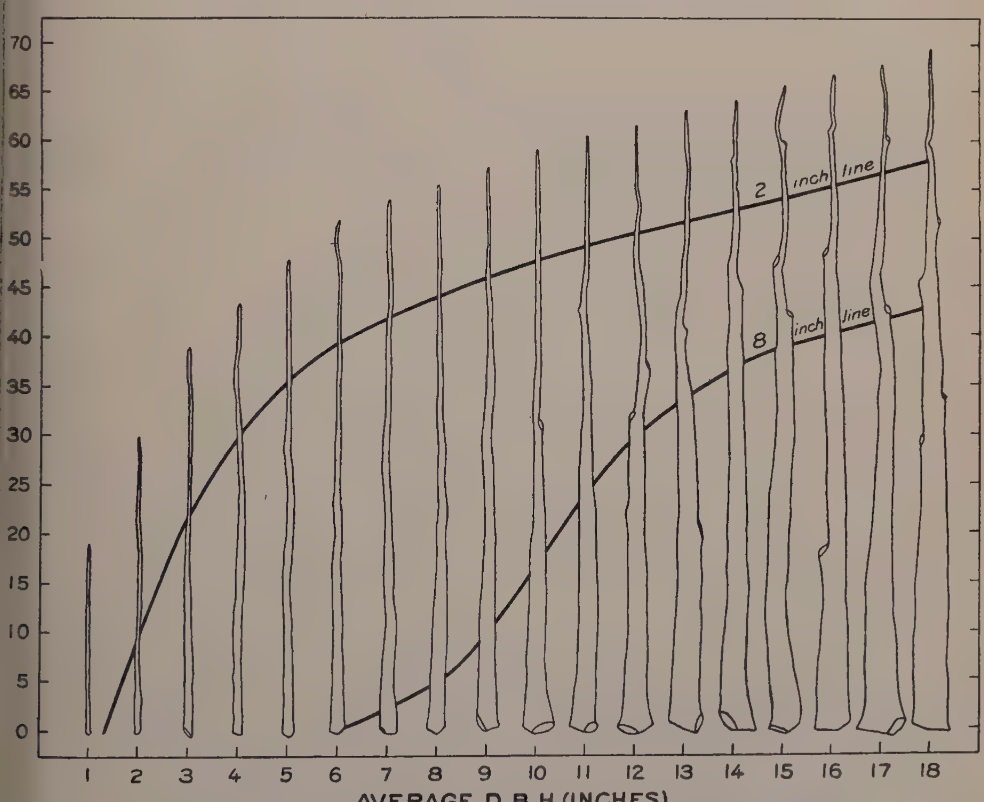

Fig. 2.—Sketch of average tree in each d.b.h. class.

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Of Oregon's primary income 91 per cent is accounted for by forest products, ag culture, and manufacturing. Of this 91 per cent, forest products contribute 43 cent; agriculture 24 per cent; and manufacturing (other than of forest products) per cent.

NORTHERN WHITE PINE IN THE SOUTHERN APPALACHIANS[1]

By J. A. COPE

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The author makes an interesting report of the occurrence of white pine in the southern portion of its natural range. Lumbering, fire and insects have materially reduced its distribution and it meets aggressive competition from the southern pines in some localities for occupation of abandoned fields. Its excellent growth rate, however, indicates that the species should have an important place in southern mountain forestry. The author found little real danger from the blister rust or weevils.

WHERE ARE THE commercial stands of white pine, if any, in the Southern Appalachians? Are ey increasing, holding their own, or de- easing? Are there enough ribes associ- ed with the white pine in this region to sure the definite establishment of the nite pine blister rust throughout the tural range of white pine in the South? there is an abundance of ribes, is there ough white pine to justify the institu- on of eradication measures such as are force in New England and New York? hese were some of the questions that the fice of Blister Rust Control of the U. S. ureau of Plant Industry wished to have nswered.

As a basis for future intensive study these questions, the author was given e opportunity in the summer of 1930 to ake an extensive reconnaissance of the xisting white pine areas in the states of aryland, West Virginia, Kentucky, Ten- essee, Virginia, North Carolina and eorgia. In the course of this trip, cov- ing 7,500 miles, practically all sections the Appalachian Cordillera south of e Mason and Dixon Line were visited and 96 officials in private, state and government employ interviewed. This preliminary reconnaissance convinced the writer that within certain limitations white pine might well have an important future in the Southern Appalachians. These findings are herewith briefly summarized.

Original Distribution of White Pine

The term Southern Appalachians[2] as here used includes that broad belt of mountain, valley and plateau extending on a general northeast-southwest axis through the states of Maryland, Virginia, West Virginia, Kentucky, Tennessee, North Carolina, Georgia and Alabama. This association of such pronouncedly different physiographic features as mountain, valley and plateau is naturally accompanied by wide variations in altitude.

The valley floor in East Tennessee is under 1,000 feet, while many peaks of the "Great Smokies" along the Tennessee-North Carolina border, plainly visible from the valley, are well over 6,000 feet. Within this altitudinal range white pine occupied the middle ground. The maxi-

[1]The work reported in this paper was performed for the Office of Blister Rust Control, Bureau of lant Industry, U. S. Dept. of Agriculture, and is published with the Bureau's permission.

Following the terminology set forth in the Check List, the term northern white pine (*Pinus robus* L.) is used in the title to this article but any one who has seen the magnificent specimens white pine that are still to be found growing in Tennessee, North Carolina and Georgia, wonders a it as to the appropriateness of the adjective *north.* It seems too exclusive!

[2]The true Southern Appalachian province comprises only that portion of the great mountain chain uth of a theoretical line from the eastern-most point of Kentucky, southeasterly across Virginia d North Carolina, toward Cape Fear.

mum distribution was between 2,500 and 3,500 feet, tapering to a lower limit of 1,000 feet and an upper limit of 4,500 feet. Planted stands of white pine have been found, however, growing satisfactorily both above and below these natural limits.

Within this favored altitudinal range evidences indicate that white pine was originally very generally distributed through the Southern Appalachian region. An exception to this general distribution of white pine was found in the Allegheny Plateau in West Virginia, and in the Cumberland Plateau in Kentucky. Both of these regions are within the favored altitudinal zone for white pine, but so far as could be ascertained, whole counties in both Kentucky and West Virginia never contained any commercial stands of white pine. Even botanically there are many counties in the plateau sections of West Virginia and Kentucky where white pine was never reported.

Following the trail of the White Pine specifically by states in the Southern Appalachians these main facts were noted:

Originally it occurred in commercial quantities in Maryland, west of the Blue Ridge Mountains only.

In West Virginia the commercial distribution of white pine seems to have been confined to three main areas:

1. The Blue Stone and other tributaries of the New River in Raleigh, Mercer, Sumner and Monroe Counties.

2. The Greenbrier River Drainage in Greenbrier and Pocahontas Counties.

3. The Potomac River Drainage in Pocahontas, Grant and Hardy Counties.

In Kentucky the original commercial distribution of white pine was probably confined to the counties of Menifee, Powell, Wolfe and Morgan in the east-central part of the state.

In Virginia following down along the "Allegheny Front" white pine was originally very much at home on top of the Blue Ridge as well as to the west. Jun "Lonesome Pine" must surely have b white. The three great river drainages the Blue Ridge in Virginia, namely Shenandoah, the James, and the New, contained considerable white pine.

In North Carolina the first record commercial stands to the east of Blue Ridge was encountered. On e running spur ridges of the Blue Ridge Wilkes, Watauga, Caldwell and Av Counties on the upper drainages of Yadkin and Catawba Rivers, white p was originally present over a consi able area. Nor was it surprising to evidences of white pine to the west of Blue Ridge at the headwaters of the N River, since that great drainage had b characterized by white pine in both ginia and West Virginia.

In Georgia white pine continued follow along the Blue Ridge front was commercially present in Wh Union, Fannin and Rabun Counties. T region was bound to be the south commercial limit of the Northern w pine.

The Cumberland Plateau in mid-T nessee forms the western boundary of Southern Appalachian province. It marks the westward limit of the orig commercial distribution of white p Records indicate that at one time w pine was well represented in the for all over this plateau, particularly in northern section.

Original Occurrence

Within this vast territorial zone original occurrence of white pine pretty much as scattered specimens m ing up from 5 to 15 per cent of stands.

In Pennsylvania and New York, w pine reached its optimum developmen the stream valleys and on the lo slopes in association with hemlock

ardwoods. The same sites in the South-
rn Appalachians found white pine "most
t home;" only the hardwood associates
hanged with the more southern region.

On a 4,000-acre drainage unit in south-
astern Tennessee, as yet unlumbered, for
xample, white pine is commercially pres-
nt on 1,000 acres of the lower levels. A
mber cruise of this 1,000 acres showed
e following make-up by species:

Oaks (all species)	35 per cent
Tulip poplar	20 per cent
Hemlock	19 per cent
White pine	15 per cent
Others	11 per cent
Total	100 per cent

"Others" includes hickory, shortleaf
ine, hard maple, black gum and beech.

While the general distribution of white
ine ranged from 5 to 15 per cent of the
riginal stands within the favored alti-
udinal zone, well-authenticated records
ere found where white pine occupied a
ar higher percentage of the stand over
ertain limited areas, probably due to
ome great cataclysm either of fire or
ind evidently that exposed the mineral
oil over a considerable territory.

A great alluvial flat just west of the
llleghenies in Greenbrier County, West
irginia, showed by the quantities and
ize of the still sound stumps, an original
tand similar to the famous white pine
rea of northwestern Pennsylvania, known
s "Heart's Content." Similar stands must
ave occurred on Deep Creek in Garrett
ounty, Maryland on the head waters of
he Youghiogheny River; and in the fa-
nous Shady Valley, Johnson County, Ten-
essee. A 2,000-acre tract running 30 per
ent white pine and 70 per cent white oak
s still standing in Bland County, south-
est Virginia. In Unicoi County, Tennes-
ee, an almost pure stand of old-growth
hite pine, 100 acres in area, was noted
n a bench at an elevation of 3,500 feet. In North Carolina east of the Blue Ridge a 50,000-acre tract runs nearly 40 per cent white pine. This particular tract, so far as the writer could ascertain, is the largest area of virgin white pine still standing in the Southern Appalachians.

These instances are obviously exceptional. A figure of 10 per cent would be representative for the original occurrence of white pine over the territory. This refers to the sites favorable to white pine. If the timber of the upper slopes were also included the percentage of white pine would have to be reduced from ten to three over large portions of the Southern Appalachians.

Present Occurrence of White Pine

Unfortunately, white pine has not been able to maintain generally its representation in the stands of today throughout the Southern Appalachians. Almost complete extinction has taken place in Garrett County, Maryland; over large sections of the west side of the "Allegheny Front" in West Virginia and Virginia. White pine is but a memory in the Cumberland Plateau of Tennessee, and even in North Carolina one learns by inquiry of old timers and not by observation, since there are no white pine trees to observe, that the village of Pineola derived its name from the wonderful stands of that species on the lower slopes of Grandfather Mountain. Only in the most inaccessible and out-of-the-way places, or where a small tract has been tied up in litigation, is there a vestige of virgin white pine left, and no second or third generation has followed.

The reasons are not far to seek. In fact the history of white pine in the south has been a repetition of the history of white pine in Pennsylvania and New York. Lumbering followed by devasting fires have removed both seed trees and reproduction. Because of the great length

of the fire seasons in the Southern Appalachians than in New York and Pennsylvania, and of the slower development of organized forest protection in the former region, the destruction of white pine has been more complete.

Drought and bark beetles combined to destroy the mature white pine on an 80-mile stretch of forest in the Alleghenies of Virginia and West Virginia in the closing decade of the last century.

Judging by the rapidity with which white pine seeds up abandoned fields in the more northern part of its range, it might be expected that it would show the same characteristic in the Southern Appalachians. This, in fact, it does to some extent where seed trees are available and fire protection is assured. On the Appalachian Plateau in West Virginia, particularly in Greenbrier and Pendleton Counties, numerous instances were observed where white pine has come in as pure stands on abandoned fields. The same is true in the farming sections of Madison, Buncombe and Henderson Counties in western North Carolina.

On the other hand, it was also observed that whatever white pine seed trees and southern pine seed trees (chiefly shortleaf, Virginia scrub and pitch pine) compete by means of their seed for possession of a cleared field, the southern pines seem more quickly to establish themselves. The resultant stand is preponderantly southern pine in make-up. This situation becomes more noticeable the farther south one goes. It is also noticeable in Virginia and West Virginia at the lower elevations. (Virginia scrub pine is the dominant species in the old field reproduction here.) General observations seemed to indicate that the drier and hotter the site, the more preponderantly the young stand would be southern pine in make-up, even though there were white pine seed trees in the vicinity. White pine would eventually have become established in these open areas, but the southern pines wi more frequent seed years and more pr lific seeding have possessed these op areas almost to the complete exclusion white pine.

In north Georgia measurements we taken in a 25-year old mixed pine sta which had become established in an aba doned field. In the woods bordering th field were both white pine and shortle pine of seed-bearing age in equal nu bers and of the same proximity to t field. The stand was 94 per cent sho leaf and 6 per cent white pine. T white pine averaged from 7 to 9 inch in d.b.h. and from 45 to 50 feet high contrasted with from 3 to 5 inches d.b for the shortleaf, which in the 25 yea had reached a height of 40 feet. The was no question of the ability of t white pine to grow once it had becon established.

In the opinion of the writer then, the four factors have seriously limited t present occurrence of white pine in t Southern Appalachians:

1. Lumbering.
2. Fire.
3. Bark beetles.
4. The superior ability of the yell pines to repossess open areas.

Growth Rate of White Pine in th Southern Appalachians

It is refreshing to turn from this n too optimistic picture of the future white pine of the Southern Appalachia to a consideration of actual growth f ures of white pine where it has had opportunity to develop unhandicapped fire or shade, here at the southern e tension of its range.

Where conditions are favorable wh pine lives up to its reputation of bei a fast-growing species. In fact, with t longer growing season it might be e pected that yields in natural stands wou

greater than those obtained in the ortheast. For purpose of comparison othingham's Bulletin *White Pine Under orest Management* is of value. This bultin gives data on height, diameter and lume growth on natural stands in New ampshire divided according to the site to Quality I, II and III.

In West Virginia a 40-year old stand ming in on an old field averaged 50 et in height and showed a diameter nge of from 4 to 14 inches; there were 0 live trees per acre. This stand would me under what Frothingham classes as te Quality II.

On the Monongahela National Forest in est Virginia an example was found here white pine and tulip poplar had eded in simultaneously on an old field. he site was on a bench about 100 feet ove the Cheat River five miles north of arsons. The soil was a clay loam. The e of the stand was 45 years, as near as uld be determined by repeated borings ith the increment borer. On the basis of one-tenth acre carefully measured plot e results given in Table 1 are shown. The average diameter of the dominant hite pine was 11.8 inches and of the ominant tulip poplar, 9.5 inches. This a difference of 2 inches in diameter in avor of white pine, in 45 years. However, diameter growth is not a good indicator of site quality. In height growth the tulip poplars were in the 80-foot height class, and the white pine in the 70-foot height class. Comparing the height growth of white pine on this plot with Frothingham's Yield Table, it is found to be Site Quality I. It is interesting, however, to note that white pine in a favored spot in West Virginia has only grown 10 feet less in height in 45 years than tulip poplar which justly is regarded as the fastest growing commercial species in the Southern Appalachians.

Perhaps the most remarkable showing of height growth in white pine, however, is to be found in North Carolina and north Georgia. On an abandoned field in the French Board district of the Pisgah National Forest a 25-year old stand of white pine showed frequent spacing of 4 feet between the nodes and 2.5 and 3 feet were the rule rather than the exception. Similar rapid height growth was found in sections of the Cherokee National Forest particularly on Cooper Creek in north Georgia.

When it comes to planted stands of white pine the growth rate is still more significant particularly in North Carolina and the same might be considered true for

TABLE 1

STAND TABLE OF TULIP POPLAR AND WHITE PINE IN 45-YEAR-OLD STAND, WEST VIRGINIA ONE-TENTH-ACRE PLOT

	White pine				Tulip poplar		Others		
D. b. h.	Dominant	Inter-mediate	Overtopped	Dead	Dominant	Inter-mediate	Dominant	Inter-mediate	Overtopped
5	—	—	—	5	—	3	—	1	2
6	—	1	1	2	—	4	1	—	—
7	—	1	—	2	—	2	—	—	—
8	—	1	—	—	2	1	—	—	—
9	1	2	—	—	—	—	—	—	—
10	4	1	—	—	—	—	1	—	—
11	1	—	—	—	2	—	—	—	—
12	3	—	—	—	—	—	—	—	—
13	1	—	—	—	—	—	—	—	—
14	1	—	—	—	—	—	—	—	—
15	2	—	—	—	—	—	—	—	—
Totals	13	6	1	9	4	10	2	1	2

north Georgia if older plantations were available for comparison.

In North Carolina the recently published bulletin concerning the Biltmore Plantations, (Miscellaneous Publication No. 61 of the U. S. Department of Agriculture) indicates that white pine on the very best sites at Biltmore has obtained a maximum growth of 5,060 cubic feet in 26 years, or 195 cubic feet per acre per year. The best sites in New Hampshire according to Frothingham, produced an annual growth of 120 cubic feet at the age of 25 years.

The writer had the privilege of seeing and measuring one plantation of white pine in North Carolina that far exceeds in growth rate that achieved by the Biltmore white pine. This 32-year old plantation is located in the village limits of Highland, Franklin County, North Carolina, on the top of the Blue Ridge at an elevation of 3,600 feet. In 1909 a 15-acre plantation was set out using 2-1 stock from the Biltmore Estate. Measurements were made in August 1930 after 22 growing seasons on a one-tenth-acre plot. The results are given in Table 2. The growth of this plantation, therefore, has been 240 cubic feet per year. It is interesting to note that annual growth at the age of 25 for fully stocked stands of slash pine, universally conceded to be the fastest growing pine in the South, is about 200 cubic feet per year, on the very best site according to Circular 124 of th
U. S. Department of Agriculture.

Currants and Gooseberries in the Southern Appalachians

If white pine, properly established ar protected from fire, can grow so satisfa torily in the Southern Appalachians wh chance has it of surviving in face of th slow but sure southern advance of th white pine blister rust.[3]

State botanists, foresters and fore pathologists describe three species of rib as native to the Southern Appalachian proper, the smooth or roundleaf goos berry, (*Ribes rotundifolium* Michx.); th prickly or pasture gooseberry (*Rib cynosbati* L.); and the skunk curra (*Ribes glandulosum* Grauer). All thr of these species were found and readi identified in the field.

At the outset of the field investigatio the writer was informed by various a thorities that white pine blister rust c fered no problem in the Southern App lachians, that is, south of Virginia, b cause the native ribes did not occur the same altitudinal zone with the whi pine.

While very much inclined to questio this general statement, and determined any rate to test it rigidly in the field, th writer concluded by the end of the sun mer that there was a very definite corr

Table 2

DEVELOPMENT OF A 15-ACRE WHITE PINE PLANTATION ON THE BILTMORE ESTATE

Dominants			Intermediates			Overtopped		
Number	Average d. b. h.	Heights	Number	Average d. b. h.	Heights	Number	Average d. b. h.	Heights
37	8.1	45-55	37	6.1	37-45	27	4.5	30-35

Total number of live trees per acre, 1010.
Total cubic volume per acre, 5460 cu. ft.

[3]At the time this investigation was made (1930) no rust on white pine had been reported south the Mason-Dixon Line. During the late summer of 1931 evidence of white pine blister rust was fou on leaves of ribes in Maryland, Virginia and West Virginia, and on white pine in Maryland.

lation between altitude and ribes distribution in the Southern Appalachians.

This relationship is particularly pronounced in the case of *Ribes rotundifolum,* often called the northern smooth gooseberry. In Maryland it was first encountered in Washington County at elevations of around 2,000 feet but never below 1,500 feet. It was not found in the relatively low mountains of eastern Allegheny County. In Garrett County, Maryland this species is plentiful on tops of all the ridges which range between 2,500 and 3,000 feet, but in the valleys it is entirely absent. As the investigations were pursued further southward this same general altitudinal relationship seemed to hold true. In progressing southward through Virginia, West Virginia, North Carolina and Tennessee, the smooth gooseberry, always present at the top of the mountains, stops at progressively higher elevations on the mountain slopes as the higher mountains are reached. Put in another way, the writer never found this species on the lower slopes or the ridge tops of hills under 2,500 feet, (rarely below 3,000 feet) in the states of Virginia, North Carolina and Tennessee.[4] On Mt. Mitchell, the highest peak east of the Rockies, the two most conspicuous pieces of vegetation at the peak are two five-foot bushes of the smooth gooseberry. On the way up and the way down this species was found plentiful only above the 3,500-foot contour.

The range of the skunk currant was found to be even more restricted than that of the smooth gooseberry. It was found on the very summit of Spruce Mountain in West Virginia at 4,800 feet, of White Face in Virginia at 5,260 feet, and of Mitchell in North Carolina at 6,720 feet. For practical purposes the range of the skunk currant in the Southern Appalachians may be considered as coinciding with that of red spruce which is very far removed from the zone of white pine.

The prickly gooseberry is less frequent in occurrence and less widely distributed in the Southern Appalachians than the smooth goosebery. It is found scatteringly all through the white pine zone in West Virginia, and in the valley of Virginia as far south as the Shenandoah National Forest. But from there on south in North Carolina and Tennessee, it is so scattered and sparse in its occurrence as to be negligible. The writer discovered only one bush during the ten days spent in the mountains of western North Carolina though search was persistent. In Tennessee and north Georgia none was found nor could any authentic record of its occurrence in these two states be discovered.

From the above it would seem that foresters interested in encouraging white pine in the Southern Appalachians have little to fear from a southern advance of the white pine blister rust. In Maryland, West Virginia and Virginia eradication of ribes must be continued along the lines already initiated in the Shenandoah National Forest and the Monongahela National Forest. In North Carolina, Tennessee and north Georgia where white pine has shown such excellent growth rates, the amount of ribes (*R. cynosbati*) present in the altitudinal zones in which white pine thrives is so small that eradication costs will be almost negligible.

[4] I am informed by the Office of Blister Rust Control that in the Shenandoah National Forest many smooth gooseberries had already been destroyed in the North River valley and tributaries at elevations as low as 1,500 feet, while in the Natural Bridge National Forest this species was found at an elevation of approximately 1,900 feet on Staton's Creek. This species has also been found at elevations of 1,100 feet and 1,400 feet in Washington County, Maryland, and at 1,000 feet in Frederick County, Virginia.

White Pine Weevil

In some sections of Pennsylvania, New York and New England this serious pest is sometimes a greater obstacle to the successful development of a merchantable white pine stand than the white pine blister rust.

In Virginia and West Virginia evidences of white pine weevil work were noted in plantations and natural reproduction. But nowhere were more than 5 per cent of the young trees attacked. Probably the lack of large areas of open-grown white pine in either plantations or natural stands in the South, which provide ideal conditions for the increase of the white pine weevil, accounts at least in part for this condition. Another contributing factor in keeping down the weevil, is believed to be the activity of downy wood-peckers.

On the Shenandoah National Forest, weeviled leaders in a 12-year old white pine plantation were examined in July. In every case downy wood-peckers (identification made by U. S. Biological Survey from specimens of excavated leaders sent to Washington) had torn the outer bark from the weeviled dead leader and with unerring accuracy had pecked into the pupal chamber and presumably devoured the occupant. Often as many as 20 such excavations were found on a dead leader and in no case were any live pupa found though the examination was made before the season for the emergence of the adult weevils.

Nowhere in the north has the writer seen such thoroughgoing weevil control by means of birds. Similar activity of the wood-peckers was also observed in Tennessee and Kentucky.

Conclusion

The original distribution of white pine in the Southern Appalachians has been very much reduced by lumbering, fire and insects. In the establishment of reproduction on abandoned fields many of the southern pines offer serious competition.

The excellent growth rate of white pine in the South Appalachians, as shown in both natural stands and in plantations, indicate that it should have an important place in the forests of these mountains.

The control of white pine blister rust and white pine weevil, the two most serious enemies of white pine in the northern part of its range, do not present so difficult or expensive a task.

It was a Connecticut Yankee who first made wooden nutmegs, but it remained for an Oregonian to manufacture wooden nest eggs of western red cedar, and do a prosperous business turning them out. It is said the hens approved of them because they warm more easily than glass or porcelain and their odor is distasteful to vermin.

THE EFFECT OF THE CONCENTRATION OF THE CULTURE SOLUTION ON SEEDLINGS OF PONDEROSA PINE

By JOSEPH HOWELL, JR.

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THE CONCENTRATION of the soil solution is a factor in plant production that cannot be overlooked. Slight variations in concentration of the liquid phase are not generally effective because of the fact that plant variation is generally large. This paper will present some data on the effect of the total salt concentration of the culture solution on seedlings of ponderosa pine (*Pinus ponderosa,* Law.).

Selected seedlings of ponderosa pine were grown in the California culture solution of various concentrations for a period of nineteen weeks. The plants were harvested at the termination of the growth period and the measurements as listed in Table 2 were taken.

The California culture solution (1419 ppm.) was used as a standard with which the others were compared. The cultures used were as follows; 0.05 normal (70.95 ppm.); 0.10 normal (141.9 ppm.); 0.50 normal (709.5 ppm.); normal California solution (1419 ppm.); 2 normal (2838 ppm.); and 4 normal (5676 ppm.). Ferric tartrate was added at frequent intervals in order to prevent chlorosis. The cultures were renewed at frequent intervals in order to prevent any serious changes in concentration or composition. The cultures were maintained at a pH 5.0 by the addition of potassium hydroxide or sulfuric acid.

An attempt was made to grow seedlings in a culture with a concentration of 6 normal (11352 ppm.) but all the plants succumbed shortly after planting.

The measurements for the heights of tops of the plants grown in this experiment did not indicate any significant differences under the conditions imposed. Nevertheless, it is notable that there were some differences, even though slight. However, when the measurements for the length of tap roots were examined significant differences were found. The longest roots were in the more dilute cultures and the shortest in the more concentrated solutions. The dry weight of tops and roots varied considerably with the concentration of the cultures though the results were not orderly. The dry weight of the roots of the plants growing in the culture of 0.10 normal did not seem to fit and no explanation could be offered for this departure. The type of root system varied with the concentration of the culture solution though no data are here given. A dilute solution tended to produce an extensive root system with many lateral roots, while a more concentrated culture tended to produce a less extensive root system with few laterals. In a dilute solution the plant must put forth a more ex-

TABLE 1

COMPOSITION OF THE STOCK AND CULTURE SOLUTIONS

Salts	Molar concentration grams per liter of stock solution	California solution c. c. of molar solution per liter	Ions	Parts per million
$Ca(NO_3)_2 4H_2O$	236.2	3.9	Ca	157
			Mg	55
KNO_3	101.1	3.6	K	181
$MgSO_4 7H_2O$	246.5	2.2	NO_3	709
			SO_4	217
KH_2PO_4	136.2	1.1	PO_4	105

tensive root system than does a plant in a more concentrated culture in order that it may secure sufficient elements for growth.

The results of the measurements for the plants growing in the cultures of 0.50 and 1.00 normal were nearly identical thus showing that concentration between certain limits is not of great importance. Nevertheless, the extremes of concentration tend to produce significant results.

In conclusion, the seedlings of ponderosa pine respond to the concentration of the culture solution, and therefore, the results of this experiment tend to show that the concentration of the soil solution may influence to some extent the type of root system that a plant will produce.

TABLE 2

MEASUREMENTS OF PLANTS GROWN IN WATER CULTURES OF VARIOUS TOTAL CONCENTRATIONS

Concentration of solution	Height of tops Centimeters		Length of roots Centimeters		Dry weight of tops. Grams		Dry weight of roots. Grams		Total dry weight Grams	
	Mean	P. E.	Mean	P. E.	Mean	Relative yield in per cent	Mean	Relative yield in per cent	Mean	Relative yield in per cent
0.05	8.45	0.83	77.40	6.92	0.54	51.0	0.83	95.4	1.37	70.6
0.10	9.70	1.45	64.50	5.25	0.86	81.2	0.75	85.9	1.60	82.6
0.50	11.39	1.06	58.87	4.24	1.05	99.1	0.87	100.5	1.92	99.2
1.00	11.60	1.15	59.38	8.08	1.06	100.0	0.87	100.0	1.94	100.0
2.00	10.93	0.85	50.11	4.38	0.81	76.4	0.83	95.1	1.64	84.3
4.00	10.29	1.60	34.96	5.28	0.91	85.9	0.67	77.4	1.59	81.8

In the books hitherto published on the cultivation of Forest Trees, the rules have been very short and confined: Their authors seem generally to have adopted the opinion, which yet unhappily prevails amongst the greatest number of unexperienced planters, that when they have put a young tree in the ground, they have done their duty, and that their labours are at an end: But such are somewhat like unnatural parents, who neglect to tend and foster their infant offspring, since trees, as well as animals, must have food and discipline, to rear them to strength, maturity, and good order.

From *A Treatise On Forest-Trees*, by William Boutcher, Dublin, 1784.

QUALITY VERSUS SIZE AS AN INDEX OF A PROFITABLE TREE: LOBLOLLY PINE

By BENSON H. PAUL

Silviculturist, U. S. Forest Products Laboratory[1]

Size alone is not a criterion of the profitable tree. Quality is of collateral importance. Quality depends upon the conditions that have existed in the forest during its life. How quality affects the value of the tree, and how the silviculturist may control it in the case of loblolly pine is indicated in this brief article.

ANALYSIS OF LUMBER grades and the net values of the lumber cut from individual trees in second-growth stands of loblolly pine shows that there may be a considerable range in the size at which the trees may be cut into lumber at a profit, depending upon conditions that have existed in the forest during its life. Information of this kind gained from studies of merchantable second-growth stands will prove of greatest value if applied to young stands now in process of formation.

It was found in the investigation that trees as large as 16 or 17 inches in diameter at breast height sometimes were handled at a loss because they contained only lumber of low grade, whereas under other circumstances trees as small as 10 or 11 inches in diameter produced lumber of such high quality that it more than equaled its cost of manufacture. In other words, within certain limits the quality, or grade, of the lumber produced rather than the size of the tree largely determined whether it could be converted into lumber at a profit or a loss. On account of the relatively wide gap in price between common and select grades of lumber, the amount of select material obtainable has a great influence upon tree values. Only the percentages of the B and Better grades of lumber obtained are therefore considered here in connection with the size and net value of the trees.

In intensive forest management, the lumber grade may be controlled to a considerable extent by regulating the number of trees in the stand.[2] Very dense stocking (1,200 or more trees evenly spaced per acre) of loblolly pine during the first 15 to 20 years undoubtedly will result in fairy complete natural pruning of the lower 16-foot log by the time the trees have attained 3 or 4 inches in diameter at breast height. At maturity, a high percentage of the lumber from such a stand will be of good quality even though the stand may not have been thinned and many of the trees are of relatively small diameter. However, judicious thinning of the stand at intervals following the natural pruning will increase the profit by producing an equal or greater amount of lumber in fewer trees, making possible boards or timbers of larger sizes and lower unit costs. On the other hand, stands insufficiently stocked at first must be pruned if the lateral branches are to be removed in time to secure high grade lumber in the usual second-growth rotation of 60 years or less. It is in such understocked stands that trees of relatively large diameter fail to produce lumber of the high quality desired.

In most logging operations, therefore,

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[1]Maintained at Madison, Wis., in coöperation with the University of Wisconsin.

[2]Paul, B. H., The Relation of Certain Forest Conditions to the Quality and Value of Second-Growth Loblolly Pine Lumber, Journal of Forestry, Vol. XXX, No. 1, pp. 4-21, 1932.

unless the trees to be cut are carefully selected, some of them will not yield sufficient lumber or lumber of the quality required to pay the cost of logging and lumber manufacture.[3]

The variation in the value of trees of the same diameter class may be seen in Figure 1 in which the percentage of B and better lumber obtained individuall[y] from 15-inch trees in two second-growth loblolly pine stands is plotted against th[e] loss or net value of the tree from whic[h] it was cut. Values of individual trees i[n] the 15-inch diameter class range fro[m] losses as great as 40 cents per tree to ne[t] values of $2.25 per tree. In the sam[e]

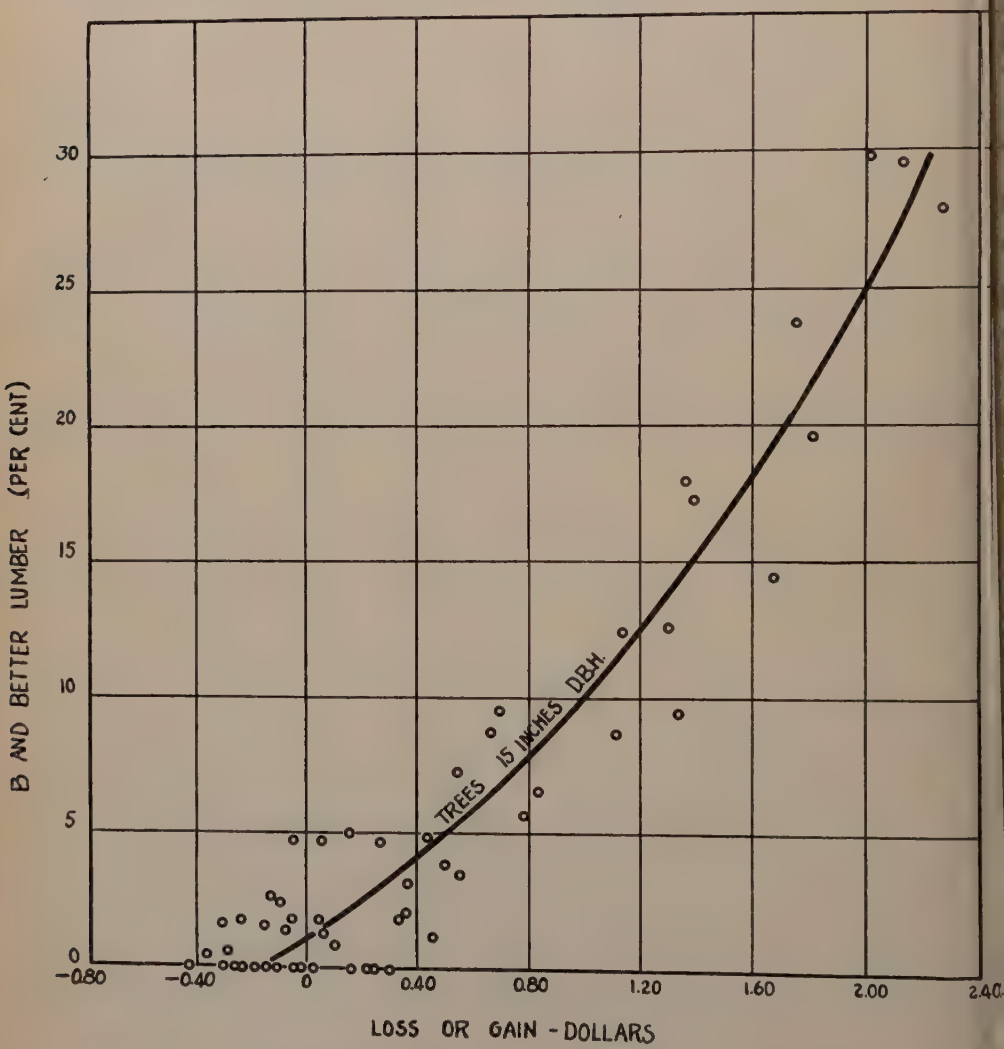

Fig. 1.—Relation of percentage yield of B and Better lumber to net value of loblolly pine trees 15 inches in diameter at breast height.

[3]Garver, R. D., et al. Selective Logging, *Virginia Forest Service Publication* No. 43, pp. 1-59, illustrated. 1931.

stands the variation in the diameter of trees which produced lumber just equal to the cost of production ranged from 10 to 17 inches.

On the basis of the data presented here it appears to be well worth while from the economic point of view to give these stands the necessary attention, either by thinning or pruning, to secure trees of large size containing relatively high percentages of lumber in the best grades. Lack of appropriate silvicultural treatment at the proper time is likely either to delay the time when a stand may be harvested with profit or result in conditions that will entirely prevent profitable marketing of the trees because they will contain only lumber of low grade.

Apportionment of $5,000,000 in emergency forest highway funds to be expended in 34 states and territories in the fiscal year 1933 has been approved by Secretary of Agriculture Hyde. Building of new highways in the national forests will be rushed to aid in relief of unemployment and to open up the national forests to greater use and for protection from forest fires. The sums apportioned are part of the $322,000,000 fund voted by Congress for public works as an emergency relief measure. The national forest highway fund is allocated, half according to the national forest area within the state, and half according to the ratio that the value of national forest land in the state bears to the total value of national forest lands in all the states.

FOREST COVER IN RELATION TO UPLAND GAME BIRD MANAGEMENT[1]

By GARDINER BUMP

Superintendent, Bureau of Game, N. Y. State Conservation Department, Ithaca, N. Y.

Success and progress in game and wild life management must be predicated on facts obtained by research. Wild life production and administration presents a fertile, fascinating, yet difficult field for needed research, the initiation of which is an additional responsibility of the forester. Mr. Bump's studies on grouse make an important contribution to basic information on this important species. His principal goal is a sustained yield of game.

GAME ADMINISTRATION as a science is rapidly coming into its own. Since most kinds of game are more or less dependent upon forest cover for shelter, the relation between forestry and this new science is obvious.

That foresters will have more responsibilities thrust upon them in connection with the management of wooded areas as a game-producing unit as well as a forest-producing unit, is not hard to foresee. Game is a crop of the soil intimately connected with the type of cover that is found thereon. Little excuse, therefore, can be found for the lackadaisical attitude of some game conservationists in the past as regards the management of the environment which produces this game.

Although hunting is one of the earliest occupations on record, it remained for the forester to develop the science of forest management long before the game conservationist gave serious attention to the science of game management. Too well accepted to bear dispute is the fact that a sustained yield of forest products must be based on a careful plan of land management. The same may be said of our game supply, yet it is only in the past few years, not only here but abroad as well, that game men are being rapidly awakened to the need for the organization of a highly specialized environment devoted to the produ tion of definite species of game.

The importance of a game crop in thi country is increasing by leaps and bound We all know that the trapper may earn hi livelihood from the forest byways. As spo and recreation, over a million men in Ne York State alone hunt and fish. In th connection it is interesting to note that in a recent survey made in eleven states in th South, 4,200,000 individuals hunted an fished, whereas the total number of individ uals interested in baseball, football, tenn and golf numbered only 4,700,000. In th last ten years hunting and fishing license in New York State have increased by 40 per cent. Annually, over 70,000 take li censes to hunt deer in our Adirondack an Catskill regions alone.

It is a tremendous problem to insure th maintenance of a sufficient game crop fo these outdoor enthusiasts to harvest. Lik the forest problem of sustained yield, it is however, no new one. The first closed sea son on deer on Long Island occurred shor ly after the American Revolution. Th legislature of the State of New York put closed season on grouse in 1837. Up unti the dawn of the twentieth century, however few measures other than restrictions o hunting and fishing were tried out. Sinc that date, methods of stocking our covert

[1]Presented at the winter meeting of the New York Section of the Society of American Foresters, at Albany, N. Y., January 29, 1932.

and streams with artificially raised game have become highly specialized. The State now produces on its game farms over 25,000 pheasants a year, and sends out for hatching over 200,000 pheasant eggs. A 950,000,000 hatch per year of fish eggs from our hatcheries is not an unusual occurrence. This year we purchased 11,000 varying hares from Maine in an attempt to restock depleted coverts. Yet with all our efforts, we are scarcely able to keep abreast of the barest needs, to say nothing of meeting sportsmen's requests.

While many refinements in the field of artificial rearing of game are being made constantly, no Aladdin's lamp can possibly be expected to solve our problems for us here. As a matter of necessity, then, we must turn to the proposition of developing the latent productive power of our natural game coverts. It is here that the forester and the game conservationist must see eye to eye in a game of give and take, if both fields are to receive the support from the public which they deserve. I sincerely believe that in many parts of this State the game crop is destined to attain an importance equal to that of the forest crop. Yearly the clamor of sportsmen, representing more than one-tenth of the total population of this State, in favor of the incorporation of game-food producing species in plans governing the planting of large coniferous areas, increases in intensity. It is up to the game conservationist to offer definite assistance to the forester if this end is to be accomplished. But here, to a much greater degree than is true of forest practice, we are handicapped by a lack of definite, reliable factual information. Too often the work has been by that easy-going team "By Guess and By Gosh." This same lack of factual information handicaps us tremendously in our attempts to organize any area on the sustained yield basis. Realizing this, the Division of Fish and Game has recently established a new Bureau of Game, with a man definitely in charge of game management work.

Still, the first job must be to get the facts.

For the past two years, my work has been to get the facts on grouse. A few paragraphs on the way in which this has been accomplished, and on the results obtained might interest you.

Story of the Grouse Investigation

Food and water. A study of the food habits of young and adult ruffed grouse covering every month in the year has been initiated. Special studies to determine the availability of necessary and optional foods throughout the year have been completed. A table giving the major food preferences of ruffed grouse month by month has been completed and published.[2]

Shelter. During the past 15 months members of the survey have flushed over 6,000 adult grouse, contacted grouse broods 221 times, found 109 drumming logs and examined 280 nests of which 266 were found this year. Time has not permitted the compilation of these data to determine the exact type of shelter preferred by grouse under the conditions mentioned. Sufficient data have been worked up, however, so that we may definitely divide the needs of grouse as regards shelter into four separate classes, as is indicated in Table 1.

It does not take a wide experience to visualize the value of such information as the above in the establishment and satisfactory maintenance of highly productive game units.

General Habits. While an abundance of valuable data has been gathered and filed under this head, there is little of unusual

[2]Conservation Department, State of New York, 21st Annual Report, 1931, Albany, N. Y.

significance.[3] Records indicate that about 80 per cent of the female grouse, whose first nest has been broken up, will renest, if this breaking up occurs during the first three weeks after the first egg is laid, whereas if it happens after that period the probability rapidly diminishes.

Reproductive capacity. A disproportionate number of either sex of a given species of game bird in coverts suitable to that species may indicate that that species is on the downhill grade. It is therefore interesting to know that the proportion of males to females, on the areas studied, is 51.5 per cent males and 48.5 per cent females. Although nearly every female grouse nested on these areas only 55.2 per cent succeeded in rearing any young at all. What happens to the rest of the broods is a subject which is being intensively studied at the present time.

Inbreeding is among the causes for the decreased number of grouse most frequently cited by grouse hunters. In order to determine scientifically whether or not inbreeding occurred to any marked extent, a large number of grouse were trapped, conspicuously marked and belled, and released. Their subsequent wanderings accurately reported by field men formed the basis for our feeling that inbreeding seems to be a minor factor as regards its effect on grouse abundance.

Weather conditions. Much work still ha to be done on this factor. There is a grow ing accumulation of evidence, however which points to the serious effect of period of cold weather just following the hatchin of a brood of grouse. On the other hanc the ancient and honorable story of tremen dous numbers of grouse being trapped b crusts which form in the night seems to b somewhat overdone. Other than this, ex cept under distinctly abnormal condition the grouse seems to be able to take th weather much as he finds it.

Grouse enemies. One of the major prob lems in the grouse survey during the pas two seasons has been the study of grous predators. Data collected during this tim have already disclosed some startling fact

A statewide grouse nest check-up durin the late spring and early summer of 193 revealed 82 out of 210 nests destroyed b predators. Curiously enough, in the moun tainous regions of the state, damage to nes was comparatively slight, whereas in th regions of abandoned farms, or in sem agricultural areas, the destruction of nes proved to be much greater. Twelve preda tors were listed as among those which d stroyed one or more of the nests examine the skunk and the fox, particularly the gra fox being the most important.

A careful study of a large number o grouse broods indicated that 63 per cent o

Table 1

SHELTER PREFERRED BY RUFFED GROUSE

Cover type	Grouse preference type
Overgrown land or reforested land, usually of mixed hardwoods and conifers up to 10 or 12 inches in diameter.	Spring nesting grounds.
Slashings 1 to 10 years of age.	Summer feeding grounds.
Overgrown land, including bushy pastures.	Fall feeding grounds.
Reforested areas or areas of thick hardwoods and conifers, usually averaging better than 12 inches in diameter.	Winter shelter.

[3]The most useful information gathered concerns the likelihood of grouse renesting following th destruction of the first nest.

the chicks making up the average brood were destroyed through one cause or another during the first three months following hatching.

The adult grouse fared only relatively better. On one area of 2,500 acres in 1930, 33 per cent of all the adult grouse were destroyed. In 1931, on the same area, 23 per cent were killed. On this particular area the great horned owl proved to be by far the most important culprit.

Diseases and parasites. Although over 30 separate diseases and parasites are known which attack the ruffed grouse little progress has been made in determining their actual importance. A complete and careful study of their occurrence is expected within the next few years to reveal the true role they play in decimating the numbers of this fine game bird.

Man. A carefully conducted, though not entirely satisfactory study, aimed at determining the importance of man and his gun, as an enemy of grouse, resulted in a determination that not more than 10 per cent of the grouse on the areas studied were killed by hunters each year.

A competent trapper was employed to remove the vermin from a test area. A similar area was left untrapped. Seven per cent more adult grouse were found to have been killed on the area from which the vermin was not removed.

Practicability of artificial propagation. Thanks to the pioneer work of Dr. A. A. Allen, of Cornell University and the fine support given the survey by the New York State Conservation Department, 101 ruffed grouse were raised to maturity from 349 eggs. One hand-reared female grouse laid 25 eggs, but three of which were fertile, two hatched, and one chick was reared to maturity.[4] Indications are that we are on the verge of a practical solution to this age-old problem of raising grouse in captivity.

In order to determine whether or not these captive grouse would revert to the wild, even though raised in captivity, five of them were liberated. One was subsequently killed by predators. All reverted quickly and easily to a wild condition following liberation.

The story of the grouse investigation to date is essentially a story of facts. Progress must of necessity be slow and haphazard in increasing the natural propagation of grouse until such facts as these are sufficiently numerous to point clearly and distinctly to the reasons underlying the periodic disappearance of one of our finest game birds.

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[4]Since this was written our 1932 work showed that our hand-reared female grouse averaged nearly seventeen eggs apiece, two of them laying over twenty-six. Fertility ran above 80 per cent and the hatchability of the eggs was nearly as high. The resulting birds have been raised with no more than normal losses and seem strong and virile in every way.—G. B.

AN EXAMPLE OF WHITE PINE REPRODUCTION ON BURNED LANDS IN NORTHEASTERN PENNSYLVANIA

By O. M. WOOD

Allegheny Forest Experiment Station

To what distances are white pine seed trees which survive fire likely to reforest the surrounding burned area? How long will the fire-prepared seed beds be favorable to germination? How will the white pine seedlings fare in competition with hardwoods? The author had an opportunity to obtain information on these important questions on an area burned twenty-three years before and on which a few white pine seed trees survived the fire.

A GROUP OF northern white pines (*Pinus strobus* L.) of seed-bearing size, towering over a thicket of young hardwoods on a gentle slope above the headwaters of Big Loyalsock Creek in Colley Township, Sullivan County, Pennsylvania, attracted the writer's attention, in the summer of 1929, as offering an opportunity to study the natural reproduction of this species. White pine, needless to say a species of high technical value and of extremely rapid growth under favorable conditions, has dropped from a position of commanding economic importance in the Allegheny Forest Experiment Station territory to one of inconspicuousness. Its future has been a subject of study by the Station, mostly however in western Pennsylvania. The present brief investigation throws some light on the distance to which white pine seed is likely to blow from seed trees; the ability of the pine seedlings to compete with hardwood species such as aspen, cherries, and maples, which commonly follow fire on the high plateaus of northeastern Pennsylvania; the period during which seed bed conditions, originally prepared by a fire, continue to favor germination; and the influence of the weevil on the pine's competitive powers.

History of the Tract

In about 1818, according to a wel informed local resident, a small field w cleared for agriculture by one Jam Houseweart and a few years later aba doned. "James' Field" seeded to whi pine, although the area is said to ha been grazed continuously since settleme began in the region. About 1888 the su rounding forest—"mostly hemlock wi some black cherry, birch, and soft maple and, at least originally, scattered whi pine—was cut. Some of the old fie pine survived the fires which follow logging in about 1890 and again in 190 The last fire killed all the trees in th area except eleven of the old field pi Their size and condition are described Table 1.

All these trees show the effects of pa fires in catfaces and charring even into the lower limbs. Several of the are also spike-topped and have in ge eral an appearance of decadence. In fo they all show their origin to have been an open stand. They are much branch and the crooked boles suggest early wee attacks. Examination of the crowns bo by climbing the trees and from the grou with binoculars, failed to reveal any con nor were there any recent cones on t ground. Only four of the trees were

ch size that their age could be deter-
ined with the increment borer. Two of these were rotten, but the age of the other two—apparently preserved by some chance from destruction in the first slash fire—shown in Table 1.

Methods of Study

The group of old pine was located within an area of 0.64 acres and was isolated from any other seed trees in the locality. From a point arbitrarily selected as the center of the seed tree group, chain-wide strips were run in each of the four cardinal directions. See Figure 1. The north, east, and south strips were ten chains long, but the west was only six, because after the sixth chain no more white pine occurred. The tally on each one-tenth-acre plot included all the white pine, other species down to four inches d.b.h., and all stumps of the original stand. On a ten-link-wide strip through the center of each of the first twelve one-tenth-acre plots, a seedling tally of all species was made. On each of the remaining twenty-four one-tenth-acre plots, this complete tally was made for only the tenth mil-acre of this 10-link strip. For the other nine mil-acres, only the dominant seedling and all white pine were recorded. As a result of this change in method, a complete reproduction tally was made for only 144 mil-acres, although the dominant seedling regardless of species and all white pine was tallied on all of the 360 mil-acres. The pine was recorded as shaded or free of shade, and as weeviled or not weeviled. On some of the plots note was made of the abundance of both herbaceous and shrubby vegetation. Some of the dominant hardwoods along each strip were cut to determine total age and height.

Results of the Tally

The tally on 3.6 acres shows the following stumps still present: eastern hemlock 40, black cherry 4, red maple 1. No birch stumps were found, but probably only because they disintegrate rapidly. No white pine stumps were tallied, but scattered trees were known to have existed in the virgin stand very near the plots.

Establishment of Pine Seedlings in Relation to Prevailing Winds

It was the chief purpose of this study to determine how far from the seed trees white pine will seed effectively, and to correlate the direction of maximum seeding with prevailing winds.

For some years a coöperative observer reported weather conditions from Du-

Table 1

SIZE AND CONDITION OF TREES SURVIVING FIRE

Tree No.	D.B.H.	Age	Height	Condition
1	37.0	—	91.1	Dead top — porcupine damage
2	32.5	—	82.0	Good
3	28.3	—	89.0	Good
4	25.0	—	68.0	Poor
5	13.9	rot	33.0	Good — catfaced
6	22.1	—	52.0	Good
7	17.8	46	50.0	Good — catfaced
8	9.6	—	36.0	Catfaced
9	13.4	46	48.0	
10	36.1	—	72.0	Poor top — catfaced
11	{19.3 20.3}	—	66.0	Forked near ground good

shore, Pennsylvania, twelve miles west of the tract. These figures copied from the records in the office of the U. S. Weather Bureau in Philadelphia, are presented in Table 2. Unfortunately this record was discontinued before the seedlings tallied in the present study came into existence. It will be noticed that the wind was only once reported from the east during the period of observation and this was not during the season when seed would b[e] falling. During the few days in Septem[-]ber, 1929, when work was in progre[ss] on the plots, the wind was from th[e] southwest.

Table 3 shows the number of pi[ne] seedlings tallied on the 36 tenth-ac[re] plots in all four directions from the see[d] tree group. These data are also present[ed] graphically in Figure 1.

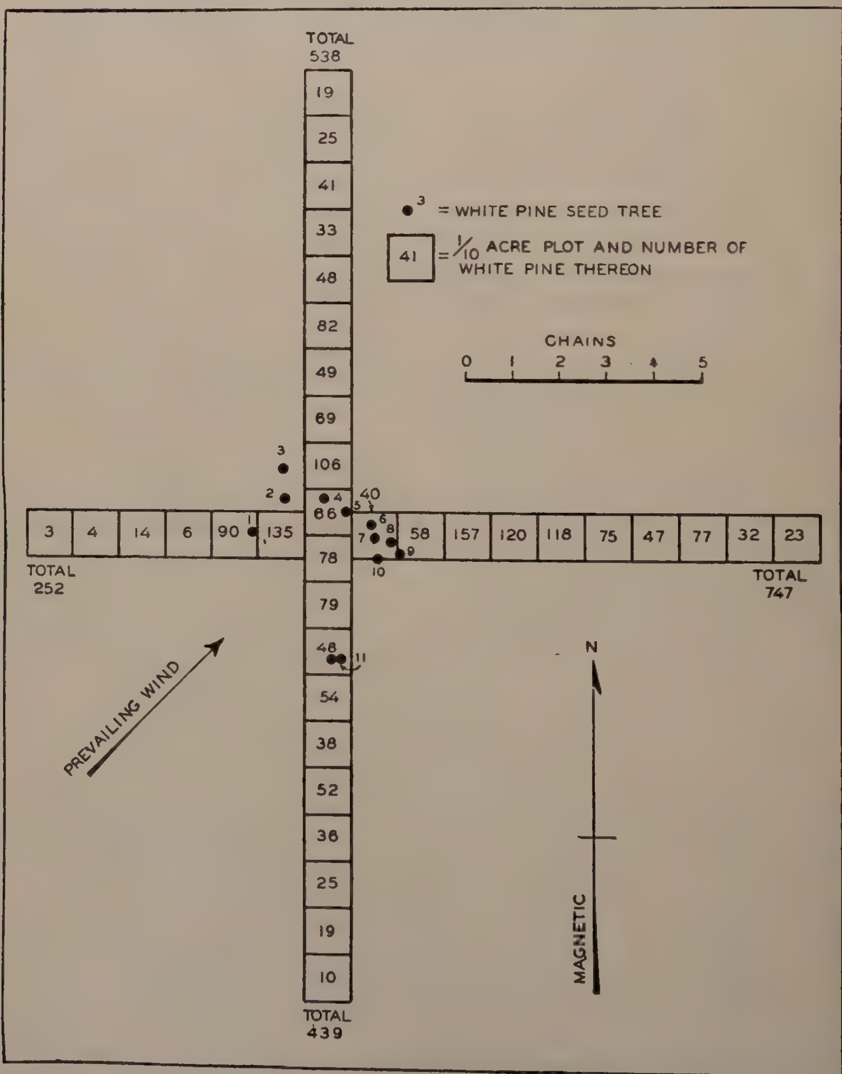

Fig. 1.—Distribution of white pine seedlings in the four cardinal directions from the seed tree group.

It will be seen that the number de-reases fairly regularly with increasing istance from the seed trees and that the reatest number occurs on the east strip nd the smallest number on the west rip. The apparent irregularities in the istribution on any one square chain can e partly explained by the presence of eed trees on that chain. Plot 1-East has pur seed trees on it and is partly shaded y two more, consequently the number of stablished seedlings is low. The same is ue to a lesser extent of Plot 1-North hich has two seed trees on it and is haded by a third. Plot 1-West has a rel-tively high number of seedlings, possi-ly because it lies east of seed tree No. . The distribution of seedlings along the outh strip is surprisingly uniform con-idering its location in reference to the eed trees and the prevailing winds. How-ver, the tenth chain of this strip is loser to a seed tree (No. 11) than the nth or even the ninth chain of the east r north strip. The size and number of amples are probably not great enough o eliminate all irregularities.

Pine Versus Hardwood Reproduction

The second-growth stand consists chiefly f aspen, red maple, northern white pine, black cherry, and pin cherry as is shown in Table 4. This table is based on a tally of 144 mil-acres, but the stand has been increased to an acre basis and the fig-ures rounded to the nearest whole num-bers. In spite of the density of the stand, 3364 stems per acre, repeated fires and grazing have created small openings throughout.

Distribution by height classes is shown in Table 5, from which certain relationships may be pointed out. By far the greatest number of stems occur in the 1 and 2-foot classes. For all other classes up to 20 feet the numbers are fairly uniform. Red maple, black cherry, and aspen occur practically through the entire range of heights. Pin cherry, characteristically enough, is totally absent in the first 4 height classes, and has the greatest average height. It must either be in the domi-nant stand or disappear. White pine, while abundant, is largely in the lower height classes and ranks lowest among the chief species in average height. The few hemlocks fall in the lower height classes.

Distribution by diameter is shown in Table 6. This table has two different bases. The one and two-inch classes are based on the tally of 144 mil-acres,

Table 2

WIND DIRECTION
DUSHORE, SULLIVAN COUNTY, PENNSYLVANIA

ear	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
897											SW	
898			S				SW	SW				
899				W	N	NW	SW	SW	S	SW	SW	SW
900	W	W	N	N	SW	SW	SW	N	SW	N	SW	SW
901	SW	SW	SW	N	N	SW	SW	SW	SW	SW	N	SW
902	SW	N	N	SW	N	SW	SW	N	SW	SW	SW	SW
903	SW	SW	SW	N	N	SW	N	SW	N	SW	SW	SW
904	SW	N	W	SW	SW	SW	SW	SW	SW	SW	SW	SW
905	N	SW	SW	SW	SW	N					SW	SW
906	SW				SW	SW	SW	SW	SW	SW	SW	SW
907										NW	W	W
908	W	W	SW	SW	E	SW	SW	SW	SW	NW	SW	SW
909	SW	SW	W	NW	S	SW	SW	SW	SW			

while the four-inch and up classes are based on a tally of thirty-six one-tenth-acre plots. To combine these is admittedly a questionable procedure, but since the tally of one and two-inch species, other than white pine, was not made on the 36 plots, it is the only method possible for presenting these data by diameter classes. The mil-acre tally includes the one and two-inch pine, and

TABLE 3

NUMBER OF PINE SEEDLINGS FOUND

No. Plot	Number of white pine seedlings										
	Successive 1/10-acre plots beginning at seed trees										
	1	2	3	4	5	6	7	8	9	10	Tota
N	66	106	69	49	82	48	33	41	25	19	538
E	40	58	157	120	118	75	47	77	32	23	747
S	78	79	48	54	38	52	36	25	19	10	439
W	135	90	6	14	4	3	—	—	—	—	252
	319	333	280	237	242	178	116	143	76	52	1976

these were also tallied on the 36 one-tenth-acre plots. A comparison of these two tallies, reduced to the same area basis, indicates that the latter tally is the lower by about 25 per cent.

Tables 5 and 6 show only imperfectly how the pine is faring in its competition with the hardwoods. Table 7 is more illuminating; it is based on a tally of 360 mil-acres. The one dominant tree, as judged by greatest height, was recorded on each mil-acre. This useful form of tally was devised by J. H. Buell at the Appalachian Forest Experiment Station. On 49, or 13.6 per cent, of the 360 mil-acres, white pine is not only dominant but also the only tree species. However, some of these trees may be overtopped by hardwoods not in their mil-acres, hence a count has been made of the number of mil-acres upon which one or more white pine exist entirely free of shade. This number is 57, or 15.8 per cent of the total.

AGE OF THE WHITE PINE

The age of some of the domina hardwoods is shown in Table 8, and all the pine on 0.36 acres in Figure Ages of the hardwoods were determin by cutting sample trees at interv along the strip, and of the pines counting the branch whorls, a meth only roughly accurate but necessary cause it was undesirable to cut any p seedlings. The maximum age of hardwoods is about the same as the terval since the last fire, but none of pine was as old as 23 years. It may that a seed year for pine did not occ until a few years after the fire or th the early seedlings did not survive. though the bulk of the seedlings

TABLE 4

COMPOSITION OF SECOND-GROWTH STAND

Species	Number per acre	Abundance per cent	Frequency
Aspen	767	22.7	45.
Red maple	669	19.9	27.
Northern white pine	655	19.5	41.
Black cherry	594	17.7	31.
Pin (fire) cherry	210	6.3	16.
Serviceberry	154	4.6	4.
Beech	112	3.3	5.
Yellow birch	84	2.5	2.
Eastern hemlock	49	1.5	4.
Choke cherry	42	1.2	2.
Sugar maple	28	0.8	1.
Total	3364	100.0	

recorded in the 14, 15, and 16-year age classes, it may be that a good seed year occurred in either 1914, 1915, or 1916, and that the spread in ages is due to the field method of measuring these ages. It may also be that seed bed conditions were at an optimum during all three of those years, so that if even a small amount of seed was produced each year, germination of a large percentage of it was assured.

It is noteworthy that the number of seedlings to establish themselves each year since 1915 tends, in spite of some irregularity in 1925-27, to become successively less. This might of course be due to the deterioration of the seed trees, with resultant decreases in amount of seed produced, but is more likely attributable to changes in seed bed conditions. After the last fire the seed bed was favorable for white pine germination, but has grown less and less so with the coming in of other vegetation. The inevitable result of this condition is a relative evenness of age of the white pine stand which the Station believes has always been more or less of a species characteristic in Pennsylvania.

TABLE 5

NUMBER OF TREES PER ACRE BASED ON A TALLY OF 144 MIL-ACRES BY HEIGHT CLASSES

Height in feet	Service-berry	Red maple	Beech	Northern white pine	Pin cherry	Black cherry	Choke cherry	Eastern hemlock	Aspen	Sugar maple	Yellow birch	Total
2	7	166	14	202	—	174	21	14	28	7	—	633
4	7	91	—	91	—	98	21	21	49	—	—	378
6	—	42	7	49	—	49	—	14	49	—	—	210
8	—	35	14	159	—	35	—	—	28	—	21	292
10	—	63	42	84	28	49	—	—	97	7	7	377
12	35	90	21	49	14	42	—	—	77	—	28	356
14	35	49	14	14	21	14	—	—	70	—	21	238
16	49	56	—	7	21	35	—	—	69	7	7	251
18	7	63	—	—	56	35	—	—	70	7	—	238
20	14	—	—	—	49	49	—	—	160	—	—	272
22	—	14	—	—	21	14	—	—	63	—	—	112
24	—	—	—	—	—	—	—	—	7	—	—	7
Average height	13.4	8.5	8.9	5.6	16.5	7.9	2.7	3.4	13.6	11.2	11.1	

TABLE 6

NUMBER OF STEMS PER ACRE BY DIAMETER CLASSES

D.B.H.	Sugar maple	Service-berry	Red maple	Yellow birch	Beech	White pine	Pin cherry	Black cherry	Aspen	Total
1	21	83	229	56	76	181	118	119	264	1139
2	7	7	76	7	—	90	104	90	264	645
4	—	—	3	—	—	8	1	25	68	105
6	—	—	—	—	—	—	—	3	9	12
8	—	—	1	—	—	—	—	—	1	2
	28	90	309	63	76	279	223	229	606	1903

Figures in this table have been rounded to whole numbers.

TABLE 7

DISTRIBUTION AS TO DOMINANCE

Species	Mil-acres where dominant Number	Per cent
Aspen	122	33.9
Northern white pine	63	17.5
Red maple	48	13.3
Black cherry	44	12.2
Pin cherry	12	3.3
Serviceberry	12	3.3
Yellow birch	4	1.2
Eastern hemlock	4	1.2
Beech	3	0.8
Sugar maple	3	0.8
No reproduction	45	12.5
Totals	360	100.0

WEEVIL DAMAGE

No study of the natural reproductio of white pine in this region can ignor damage caused by the white pine weevi The weevil, in reducing height growth is a natural factor in decreasing th number of seedlings which will surviv in competition with the fast-growin hardwoods. In this study 1366, or 6 per cent, of all the pine seedlings ta lied, were weeviled at least once. Wee vil damage was not confined to an height or diameter class in this stan

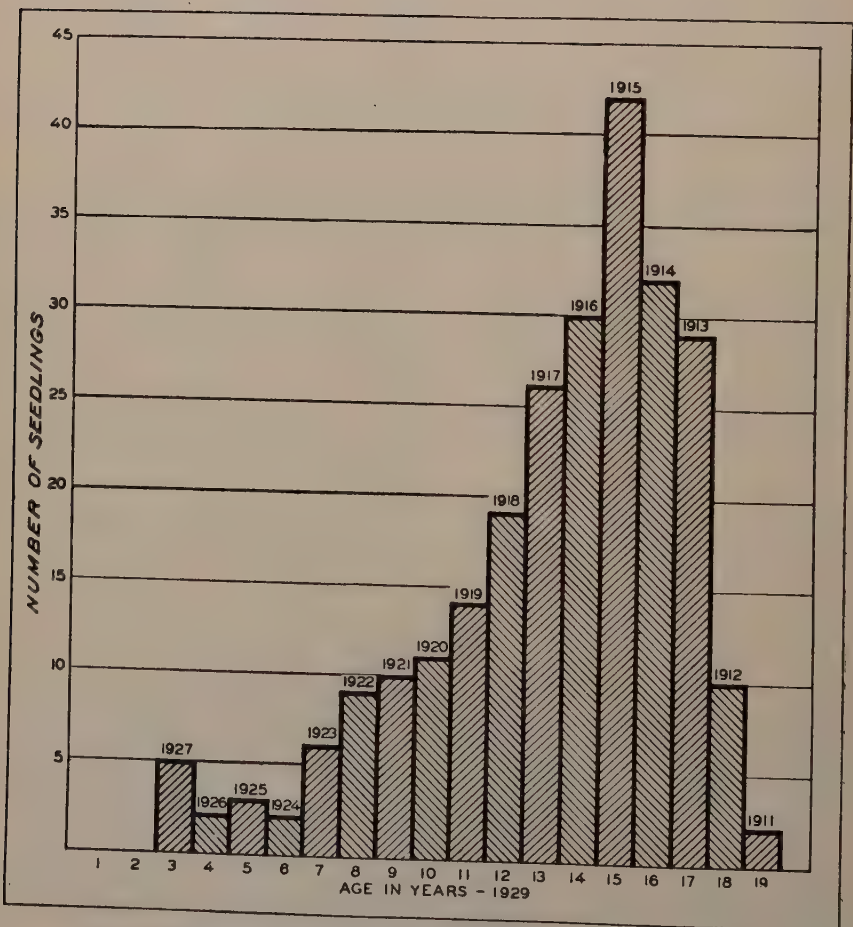

Fig. 2.—Number of white pine seedlings by age classes. Total 252.

Those seedlings tallied as free of shade have the greatest mean height, regardless of the fact that a greater percentage (90 per cent) of them were damaged by the weevil than those under shade, (59 per cent). As between weeviling and overtopping the former seems the less serious affliction.

TABLE 8

SAMPLE TREES—DOMINANT STAND OTHER THAN PINE

Species	D.B.H.	Height	Total age	Per cent crown class
Serviceberry	2	17	20	D
Aspen	3	23	21	D
Aspen	2	23	18	D
Serviceberry	2	20	22	D
Red maple	1	13	15	D
Aspen	4	23	18	D
Black cherry	4	27	23	CD
Black cherry	6	28	23	D
Pin cherry	4	22	22	D
Red maple	3	25	21	D
Black cherry	2	18	21	D
Aspen	4	21	20	D
Red maple	2	23	21	D
Average	3	22	20	

BOXES of SEEDS, and growing PLANTS of the Forest Trees, Flowering Shrubs, &c. of the American United States; are made up in the best manner and at a reasonable rate by the Author. All Orders in this line, directed for *Humphry Marshall*, of Chester County, Pennsylvania; to the care of Dr. Thomas Parke, in Philadelphia, will be carefully and punctually attended to.

Advertisement in the *ARBUSTRUM AMERICANUM: The American Grove, Or, An Alphabetical Catalogue of Forest Trees and Shrubs, Native Of The American United States.* Philadelphia, 1785.

NEW USES OF WOOD AND THEIR INFLUENCE UPON FORESTRY PRACTICE[1]

By REGINALD T. TITUS

Eastern Manager, West Coast Lumbermen's Association, New York City

Foresters have so long been forest-production minded that they have failed to realize that forest utilization is the key to forest production. The author believes that since we are still in a utilization stage we should give utilization problems more thought and study to make it more profitable and free from waste. He assembles with this brief paper a few notes on each of a number of new products using wood as a raw material.

FORESTRY HAS BEEN called a Science; if this be true it is that science pertaining to the growth of trees and the development of the forest. A more common definition of our profession is that forestry is an Art—the art of growing repeated crops of timber and the utilization of the forest's products to secure the greatest good for the most people.

No matter to which school of thought we belong we must recognize the fact that although the path of forestry has numerous ramifications, the chief and ultimate objective is the assurance of a perpetual supply of timber. In recent years other aspects of forestry have become increasingly important, and today we acknowledge that the forest is important not alone because of its timber crop, but also because of its beneficial effect in furnishing watershed protection and in diminishing the flood hazard; because of its immense recreational value which cannot be estimated in dollars; because of its influence upon hunting and fishing and other pursuits of man. Nevertheless, timber is still the most important product of privately owned forests, at least, and 80 per cent of our forests in the United States fall in this category.

There are several stages in the development of what we term "good forestry practice." In my opinion, the first stage is one of forest exploitation. This stage commences with a virgin forest and generally reaches its peak in the periods of great expansion and growth of new communities which are hewing homes and industries from the wilderness. The second stage is that dominated by forest utilization and characterized by intensive development of logging, lumber and pulp manufacturing and scientific research for new uses of forest products. Since this stage is concerned with existing stands of timber, forest protection receives considerable attention. This period lasts as long as there is a supply of virgin timber capable of producing sufficient wood to comfortably meet the demands of the territory involved. Next comes the stage of reforestation which somewhat overlaps the preceding one and also the final stage—that of forest management, with the forests maintained upon a sustained yield basis. According to this classification we in this country are now in the second stage—that of utilization—with some sections entering upon the reforestation phase. If we accept this description it obviously behooves all present-day foresters to give attention and thought to that portion of forestry which has to do chiefly with the utilization of forest products.

Ours is primarily a nation of pri

[1]Presented at the annual meeting of the New York Section of the Society of American Foresters at Albany, N. Y., January 29, 1932.

vately-owned forests. Under such conditions forestry must be able to pay its own way and return at least a slight profit or it is doomed to failure—except as a public service on publicly-owned timberlands. Private capital will grow trees commercially only when it pays to do so, consequently the forestry profession must devote its best talents to the task of making forestry profitable. Regardless of the particular phase of forestry in which one is engaged he must give attention to the economics of the existing situation and to the marketability of the forest products developed. If there is no market for the mature timber it is useless to grow trees as a crop, and there is little need for trained foresters. Because of these facts and conditions, any new uses for wood which will extend the market even slightly automatically strengthen the position of the foresters and raise the standing of our profession.

Lumber has long been and still is the most important of the tangible products of the forest. The American lumber industry, and others closely allied, have made rapid strides in their technical development during recent years, and generally speaking, timber products are now manufactured more skillfully in this country than ever before in history, here or elsewhere. In spite of better equipment and improved methods, however, we are utilizing considerably less than one-half the average standing tree. This inefficiency appreciably lessens the chances of growing crops of trees at a profit; at the same time it accelerates, needlessly, the drain upon our present stands of timber. Closer utilization of the raw material through the development of new products would mean reduced manufacturing and distributing costs, and correspondingly higher values for standing timber, which in turn, would tend to increase both the demand for foresters and their remuneration. At the same time, if this increased utilization made production of wood more profitable, and stimulated the growing of trees, the consumer would profit by virtue of having available a larger supply which could probably be secured at reduced prices. So far as the forests are concerned, better utilization would undoubtedly extend their boundaries and their life. Value is created by use, hence conservation of our forest resources through increased utilization is entirely feasible and natural. It is through the wise and efficient use of our timber that reforestation and other phases of forestry practice can be most easily and surely promoted.

New Uses of Wood

It is estimated that there are now more than 4,000 uses of wood, yet through research on the part of government laboratories and private agencies new uses are constantly being discovered. Forest industries are also developing new uses in order to convert their waste into usable products. In a paper of this limited scope it is impossible even to enumerate all of the new uses of wood. We must be content to consider rather hurriedly a few of those which are of greatest importance, or which typify a class of uses.

RAYON

Although the process for its production was invented in 1884, rayon must be given a prominent place among the new chemical uses of wood, because its manufacture has been an important industry for only a few years. Little was known of this product prior to 1900 and as recent as 1911 the consumption in the United States was relatively small. In 1929, which is the last year for which data are available, our domestic consumption was 60 times that of 1911, and the United States was the chief consumer of rayon among the nations of the world. In

that year this country accounted for 30 per cent of the total world production of 404,155,000 pounds.

According to a definition of the Committee on Textiles of the American Society for Testing Materials—"Rayon is the generic name of filaments made from various solutions of modified cellulose by pressing or drawing the cellulose solution through an orifice, and solidifying it in the form of a filament, or filaments, by means of some precipitating medium." In other words, rayon, or as it is commonly called "artificial silk," is a material produced by the chemical treatment of cellulose secured chiefly from wood. Thus by following scientific rules it is possible to take wood pulp worth as little as 5 cents per pound and convert it into thread worth $1.50 per pound.

The finished product used extensively in the manufacture of underwear, stockings, fabrics, etc., has the softness and sheen of silk, but is less strong, and even loses strength when wet. Rayon filaments are flat and because of this shape, are somewhat more lustrous, soft and pliable than the round filaments of worm silk. While rayon yarn may be used alone, probably its best opportunities lie in mixing it with real silk to produce material which is almost as strong as silk but considerable cheaper, since rayon costs only about one-quarter as much as raw worm silk. Because of this practice of mixing the real and the artificial silk, the development of rayon has not handicapped the use of worm silk. On the contrary since the introduction of rayon to this country the importation of raw silk has increased almost 100 per cent.

Rayon is produced by taking a solution of cellulose, viscous enough to form liquid threads, and forcing it through small openings into a chemical bath of air current in which the threads instantly solidify. These threads are then removed from the fixing bath by a series of drums and bobbins, are washed, dried, and twisted, then finally wound into skeins. There are four basic processes used commercially in making rayon, each of which gives a product varying in some degree or property from the others.

The most successful method and that by which at least 85 per cent of the world's output of rayon is produced is the viscose process, based on discoveries made by Cross and Bevan, two English chemists, in 1892. This is the process of most importance to foresters because while cotton linters are sometimes used, the chief source of cellulose is sulphite pulp, made principally from spruce. Balsam fir and tamarack have also been used and laboratory experiments indicate that clean pulp from almost any coniferous wood is satisfactory if properly treated. Research is now being carried on to determine the possibilities of using sulphite pulp from the more resinous woods and it is probable that in the near future important information will be developed concerning these species. To produce by this process 1 ton of salable rayon there is required 1.5 tons of sulphite pulp, 2 tons of caustic, 1.5 tons of sulphuric acid and 1,200 pounds of carbon disulphide.

The other three processes are: (1) The cellulose-acetate process. By this method using either wood pulp or cotton, approximately 7 per cent of the total is produced. The product is frequently called celanese. (2) The nitro-cellulose or collodian process. Cotton is the preferred cellulose base in this process which accounts for about 4 per cent of the total production. (3) The cuprammonium process. This method accounts for another 4 per cent, the principal raw material being cotton linters.

There are no official figures available to show the quantities of wood pulp used in the manufacture of rayon. It is estimated, however, that in 1929 the world's production by the viscose process, oper

ted almost exclusively on wood plup, was approximately 350,000,000 pounds. Since one ton of bleached sulphite pulp will produce about 1,500 pounds of rayon it may be calculated that at least 230,000 tons of wood pulp went into the production of that year.

In order to make this much sulphite pulp about 460,000 cords of wood are required.

The increase in the use of rayon has been one of the most remarkable developments in textile history. For instance, the number of American rayon plants increased from 19 in 1927 to 29 in 1929, and it is probable that the industry will continue to expand, thus creating a constantly enlarging demand for wood as the chief source of cellulose.

OTHER VISCOSE PRODUCTS

Closely allied to rayon are other products essentially the same but made into sheets instead of threads. In the manufacture of these transparent paper-like sheets, the viscose solution is extruded through very narrow slits into a settling bath, the size of the slits determining the thickness of the sheets. These other viscose products which are marketed under various trade names are growing increasingly important. In 1929 the value of those manufactured in the United States was more than twice that of the 1927 production.

The chief representative of this group of products and the one with which we probably come in contact most frequently is "cellophane." Since this material is transparent, odorless, greaseproof and can be made moistureproof it is finding a wide use in the wrapping of anything from cigarettes and candy to food products and wearing apparel.

Another interesting product of this class is a form of seamless artificial sausage skin.

INSULATING MATERIALS

The last few years have seen tremendous increases in the consumption of wall boards and insulating material. Since these products are largely made from wood fiber (much of it wood waste) the forester has a natural interest in their manufacture and in their markets.

Wall board (of wood) has been defined by the National Committee on Wood Utilization as "a type of board composed of a number of layers of chips, binder or pulp board molded or pasted together and generally 'sized' either throughout, or on the surface; it may also be nonlaminated and homogeneous in nature." Of the principal commercial wall boards those which have wood fiber, in the form of old paper, as the principal component include Agasote, Vehisote and Alton wall board. Others which are made from raw wood are Beaver-board, Compo-board, Cornell board, Fibelic, Upson board, Preswood, and several others.

So far as this paper is concerned wall board is important chiefly because it was the forerunner of a new wood product—insulating material. The insulating material industry was born about 19 years ago. The first board was such a success that in the last few years more than a dozen similar products appeared on the market. At the present time there are at least 15 insulation boards, one or more flexible quilts and one fill-type of insulation made from wood. This growth is of vital importance to the foresters of the country because the manufacturer of these products offers many opportunities to further utilize wood much of which was formerly waste.

Many of the insulating boards made from wood are manufactured by methods quite similar to those in the pulp and paper industry. An example of this type of rigid insulation is Fir-Tex, one of the boards developed in recent years. As its

name signifies, Fir-Tex is made from Douglas fir. The raw wood is reduced to chips and these are cooked for about 9 hours at a temperature of 350° F. The material is then shredded, sized with alum and rosin, felted and pressed into boards from 0.5 inch to 1.5 inches thick. The boards are 4 feet wide and are cut into lengths of from 4 to 12 feet. Plaster lath 0.5 inch thick and 12 or 18 inches wide are also made. Another pulp board is Nu-wood, made of white pine. The J-M (Johns-Manville) board is one of the several made from pure spruce fiber. Beaverboard (or Certain-teed) is also made from spruce, the chips being crushed, then mixed with diatomaceous earth and a little paper pulp. Weatherwood is made from cottonwood fiber plus a small amount of willow.

One of the most interesting of the insulating materials is Masonite which is manufactured entirely from sawmill waste. The outstanding difference between this board and the others is that its fibers are not shredded nor cooked, but are actually exploded. This process is faster than mechanical grinding and there is no loss of material, which frequently runs as high as 50 per cent in chemical pulping. In the manufacture of Masonite chips of red gum and southern yellow pine from the sawmill are subjected to a steam pressure of 1,000 pounds; the pressure, suddenly released, explodes the fibers which are then felted, pressed and dried.

There are several other insulating boards made from wood fiber, including Arborite, Birds-wood, Homosote, Insulboard, Insulite, Temloc, Ten-Test, Thermo-board and Thermo-sote.

Among the flexible forms of insulation one of the most important of those made from wood is Balsam-Wood which is manufactured from white pine, Norway pine, balsam fir and spruce. This flexible insulation differs from the boards in that the fibers are very loosely felted into a blanket rather than compactly pressed together.

ARTIFICIAL STONE

Masonry materials have long competed with wood for construction purposes, so it is somewhat gratifying to note the recent development of artificial stone products composed largely of wood, which are offered as substitutes for marble, plaster and the like.

An example of these new building materials is X-ite, a molded product composed of wood shavings, magnesite and magnesium chloride to which have been added mineral colors. About 72 per cent of the total volume is made up of pine shavings free from resin and dry. To the shavings and other constituents, the liquid magnesium chloride is slowly added and the whole thoroughly mixed. The resulting mixture is poured into moulds and there allowed to set before being cut into the required sizes for use in floors, walls and roofs. X-ite is a hard material having the appearance of stone but is considerably lighter in weight. It has the added advantage that it can be sawn or cut and nailed to wood framework. It is expected that this material and the several similar products will fill a place in the construction field somewhere in the range between marble and plaster. These compositions are largely in the experimental stage as yet, and it is impossible to forecast their future, but at least they offer interesting possibilities of new wood uses.

FLEXWOOD

Closely related to plywood is a new product called Flexwood, used primarily as a wall covering. Flexwood consists of very thin wood veneer (usually of walnut, mahogany or oak) backed with a stout fabric. The sheets of wood, measuring less than one-eightieth inch in thick-

ess, have previously gone through a ıtented process intended to break the ood into innumerable fine columns, and is is said to prevent subsequent crack-g or warping. The finished product is fficiently thin and flexible that it can be pplied in the same manner as wall aper, and gives the appearance of solid ood paneling at a fraction of the cost. lexwood can be used for wall covering some instances where regular wood aneling is excluded by building code strictions, and it will probably be wide- used in other places where the more pensive material would be prohibitive cost.

SPRUCOLITE

Sprucolite is a new product made from itka spruce. The raw material is spruce ox shook from 3/16 inch to 3/8 inch hick, 4 feet in length and of random idths. After having the moisture content educed to about 2 per cent, the pieces re impregnated with a waterproof bind-ıg agent and then assembled in layers feet square, and built into a laminated lock with each layer at right angles to djacent layers. This block is then com-ressed into a homogeneous mass of equal ensity throughout and at the same time ıe volume is reduced by from 30 to 70 er cent. The resulting material is a very ard dense mass which is strong, resilient nd possessed of a high coefficient of iction. These characteristics make Spru-olite very well adapted to use in the orm of pulleys, noiseless gears, rolls, heels and the like. At present the manu-ıcturers of this product are experiment-ıg with its use as golf club heads.

SAND-ETCHED WOOD

The beauty of carved wood has been dmired throughout the ages. Only recently one of the best known sculptors states, in the press, that in his opinion carved wood possesses an "aliveness" that cannot be achieved in cold stone. Hand carving is a laborious and expensive process but there has recently been developed a cheaper and more simple method of treating wood, known as Sand Etching. This process imparts to the wood that beauty and individuality achieved by carving and also gives to it a mellowed appearance ordinarily secured through many years of weathering. There are two different types of finish secured by this process—one is the creation of panels on which pictures or designs are etched into the wood; the other is the blasting of the timber in such a way that the soft springwood is worn away and the hard summerwood accentuated to produce a naturally beautiful effect.

For the etching process which reproduces pictures, vertical or edge-grain material is generally used. On the lumber selected there is glued a stencil of heavy paper cut according to the design and then coarse sharp sand is applied by a sand-blasting machine using 20 to 30 pounds pressure, until the wood surrounding the stencil has been sufficiently worn away to expose the picture in bold relief. The panel is finished by coloring.

The other type of sand-etching is upon flat or slash grain material without the use of a stencil. In this case the process is very simple. All that is necessary is to place the wood in front of the sand-blasting machine, which is operated as described above. The sand cuts away the softer spring wood leaving the harder summerwood exposed in figured grain. When freshly finished the wood looks like sand-scoured driftwood. It may be stained as desired, some very novel effects being secured through artistic combination of colors.

Not all woods can be sand-etched satis-

factorily. The wood should have a reasonably uniform rate of growth and there must be a great difference in hardness between the springwood and the summerwood. A fairly prominent and pleasing figure or grain is also highly desirable. Thus far Douglas fir has been the wood most commonly treated in this manner. For certain uses such as crests, scrolls, insignia and the like, deeper etching is frequently wanted, and for such purposes best results have been secured on softer woods, such as western red cedar and redwood.

Conclusion

These are but a few of the new roles now played by wood in our industries and in construction. If time permitted one might describe many others, including those numerous uses of wood flour in the manufacture of linoleums, phonograph records and various molded products. Then there is the tremendous chemical field open to the cellulose esters in the manufacture of lacquers, adhesives, etc. As a matter of fact, this brief paper has merely scratched the surface, as it has been merely an attempt to indicate the trend and incidentally to show the possible effect of new wood uses upon forestry in general.

A noted forestry educator who formerly occupied the most responsible position in public forestry in this country recently said that while foresters have long recognized forest production as the chief aim of forestry practice, we have only recently commenced to realize that forest utilization is the key to forest production. If this be true, and I believe it is, the forestry profession should continue to devote an increasing proportion of its talents and efforts to the development of new wood products

Additional uses of wood will probably mean, first, closer utilization of our current cut and the reduction of the waste resulting from present operation of wood using plants. Later there should come an increased demand for raw wood in the form of trees. In any event, the increased utilization of wood through the development of new uses, or the discovery of new products will rebound to the benefit of forestry, be it considered as science, art, profession or business.

Following a selective cutting of the mature trees on an experimental plot in eastern Oregon, the Pacific Northwest Forest Experiment Station found that the height growth of the sapling pines left unharmed more than doubled.

THE NEW-USE MIRAGE[1]

By CHARLES W. BOYCE

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The amount of wood used for such new products as pulp, rayon, insulating materials and others is not yet sufficient to effect materially the nation-wide feasibility of private forestry, but it does promise much to individual enterprises having the rare combination of research and market organization. Diversified and integrated fabrication at such plants contributes importantly to the success of their forestry operations.

WOODLAND OWNERS know that the commercial success of forest management demands something more than forestry; it requires the same ingenuity and acumen in marketing that characterizes all business. The upward sweep of the consumption trends of most wood products long ago turned their peaks and the total wood used in the United States has tended downward for a long time. But the forest area accessible to local and to national markets, and the quantity of timber immediately available for manufacture are both greater today in proportion to demand than in former years. Marketing has become the essence of forestry. Furthermore, experience tends to prove that the one-product forest like the one-crop farm has but a minor place in business; neither can hold its own. Diversification that permits intensive land utilization, that wrings from the products of land the last ounce of marketable utility, is the demand of the times, and common to all industry.

Nationally, forest owners need volume consumption, not only volume to offset the reductions in important uses, but even more important a volume, of different character that can utilize half-grown, poor-quality and inferior kinds of timber. Moreover, the forest owner needs the diversified volume not so much centralized in the national markets as decentralized in innumerable local markets throughout the country.

In the growth of new uses for wood many have seen possibilities of volume demand for wood of such a diversified nature that the economic feasibility of forestry is assured. It is true that the uses of defiberized wood such as in pulp, rayon, viscose products and a number of others have grown; but in none is there any justification from a national point of view to believe that the volume-total of former days will return. This, combined with other mitigating factors, has led to heavy liquidation which, heavy as it has been, has not been sufficient to rebuild the toppled demand structure. New uses have been as a vision of falling manna. Or is the vision a mirage?

Tremendous economic pressure bears heavy upon every industry, capital outlays for production facilities and for raw material control have exceeded any need that has yet existed. This aggravated by business depression has literally forced the most intensive research in all materials to develop new uses in order that labor and capital may be more thoroughly and profitably employed. In an important sense the research is competitive and it strikes deep. Upon its success

[1]Comments on "New Uses of Wood and Their Influence upon Forest Practice," by R. T. Titus, in this issue and presented at the annual meeting of the New York Section of the Society of American Foresters, at Albany, N. Y., January 29, 1932.

depends the solvency of many mass production industries.

In the competition between materials wood is penalized by the past depletion of quality stands near large consuming markets, by costly transportation of products from the high quality forests in the West, and by time and labor costs in using wood on the job. These and other handicaps blast hope in the development of new uses to an extent demanded by a national, economically sound forest industry commensurate with the availability of forest land, with conditions of ownership and with the secondary or public interest demands for forest cover.

Although new uses promise no increase in wood volume to effect materially the national feasibility of forestry, they do promise much in the case of individual enterprises which possess the happy but rare combination of balanced research and market organization. In series of diversified products properly marketed, is the best, in fact the only hope of a net-back-to-stumpage return sufficient to justify a high degree of forest management. Rayon demanding in the neighborhood of 100,000 cords of wood a year part of which is imported, insulating material which may now use another 100,000 cords much of which is waste from other manufacture, viscose products that do not yet approach this annual wood need, and many other so-called new uses of equally insignificant forest demand, are merely drops in a tremendous bucket. Their wood requirements are measured in thousands of cords; the need of the forest owners is measured in millions of cords. In these new uses there is chance for but few companies; nationally the forest owner must still depend upon the older and established uses of wood such as lumber, ties, posts, and poles, practically all of which are slipping downward in consumption year after year.

Analysis of successful forest enterprises tends more and more to emphasize th importance of intensive forest manag ment, not necessarily for the productio of a specific product but more especial for wrestling from land the greatest poss ble financial return regardless of produc Diversified and integrated fabrication the companion of such forestry. To pe mit the highest degree of integration an diversification new uses may play an ir portant part in the program of an ind vidual going company, particularly material wasted in other or higher form of manufacture can be utilized. Here presented the best means of converting i to a salable product the highest percen age of material grown. The extent which this integration is accomplishe is not only a measure of commercial su cess but also of the general developme of new uses and waste utilization.

In so far, therefore, as new uses resu in the intensification of manufacture th permits successful competition in fores between highly organized and efficient managed, forest-owning enterprises, the are immediately and substantially impo tant. In so far, however, as new uses the may be depended upon to bolster a fa tering demand trend for wood as a whol they have not yet become significant.

The evolutionary processes of forest and of wood use have, of course, just be gun. A forestry economy based upon th utilization of virgin forests is entire different from an economy that begin with land use. The one may well be co sidered on a national basis; the othe has not yet approached the national basis it still is and will be for sometime matter of unit organization and individu ingenuity that makes use of the land th is nearest consuming markets, that has good forest cover to begin with, and th is capable of producing timber of salab kinds at rapid growth rate. New uses a important, therefore, as they relate to th further development of going individu

terprises that fall within the best for-try and marketing chances.

Mr. Titus' description of new develop-ents in wood use is correct, but his in-rence of their significance to forestry as national enterprise are somewhat over-awn. Neither in volume nor in type of aterial used are the new uses he de-ribes of material national importance, or are they likely to be. Their great sig-ficance lies in the possibilities they pre-nted to relatively few companies that e so organized that they may make use them and in doing so create new, eeded utilities for consumers in general nd a net stumpage return for themselves ufficiently large to justify some expendi-re in forest management.

The profession must look to some other iracle or to its own ingenuity and wis-om for the answer to the forestry prob-em, and to a clearer understanding of hat the forestry problem really is. It ay be that the difficulties of the profes-ion center largely in its conception of its wn problems.

We are beginning to find that utility forestry like other businesses has its national aspects, but that the hope of its development into a substantial place in our industrial structure centers as all business centers in the private enterprises that make the best use of the best chances. Dreams of a finely spun nation-wide forest system that makes use of all available land fail to recognize the realistic power of competition. Those who must justify their recommendations before the very material but in the long run fair tribunal of profit, must not lose themselves in roseate dreams of approaching miracles that will lift them to prominence. The profession can progress only as its members meet the problems of their employers with knowledge and individual ability. Awaiting the often prophesied opportunity supposedly inherent in the timber famine or in so-called "cellulose forestry" promises the usual reward of those who await miracles. After all, we as foresters must win recognition in this material world in the usual manner—by defeating the problems that actually exist in our own restricted bailiwicks. In this, new uses may help us.

RECENT PROGRESS OF THE NORWEGIAN AGRICULTURAL AND FORESTRY CREDIT SOCIETY: SIGNIFICANCE FOR AMERICAN FARM FORESTRY

By BERNARD FRANK

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In Norway the farm woodlot forms part of the total farm credit base, whereas in this country the loan value possibilities of farm woodland have been ignored. Census data showing the large values in forest products removed each year from American farm woodlots indicate that the wooded portion of a farm has considerable loan value. The success of the Norwegian credit society here described suggests to our forest extension specialists and others that an early start be made in the determination of how credit facilities may be extended in this country. The assurance that loans may be obtained on woodlots if properly managed should encourage an owner to view the practice of forestry in a more favorable light.

THE ORGANIZATION of the Norwegian Agricultural and Forestry Credit Society and its progress up to 1926 have already been described in these pages.[1] Before summarizing its recent progress it would be of interest to sketch the background of the coöperative movement in general and its relation to the above coöperative.

The fundamental objective of the coöperative movement, whatever its phase, has always been to secure greater economic justice to both the consumer and the producer of all forms of capital and capital goods. Its leaders have consistently refrained from taking part in political activity. The movement is today of international scope and includes many American coöperatives, most of which are represented in the congresses held regularly in Europe. There are coöperatives in housing, insurance, banking, recreation, fire protection, and even the press, to name but a few.[2]

Coöperative credit is one of the many phases of the movement which had its beginnings in the latter part of the 16th century. By the 19th, all manner of coö eratives had sprung up in Great Brita and in 1843 the historical Rochdale pl was formulated and put in practice by small group of weavers.

The coöperative credit union itself w evolved and standardized in Germany Herman Schulze-Delitzsch, a judge, a Frederick W. H. Raiffeisen, a Prussi mayor. It is significant that the first s ciety arose from the difficulties of sma farmers in procuring credit for their fa operations.

Broadly speaking, a credit union is coöperative credit society organized a operating under the provisions of a sta credit union law and generally und state banking supervision. It is limited a specific group of people and manag by officers chosen from and by the me bers. Its purpose is threefold: To supp members with an easy and convenient w of saving money; to meet their cre needs at legitimate rates of interest; a to educate members in efficient manag ment of their own savings.[2]

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[1]Frank, Bernard. Norwegian Agr. and For. Credit Soc. Review in Jour. For. Vol. 29, May, 19 Pp. 843-846.

[2]Davis, Jerome. Contemporary Social Movements. 1930. Book VI. The Coöperative Movement.

Progress of the Society[3]

The Society has continued the steady ogress reported for the period 1916-925.[1]

LOANS

Loans totalling $10,920,247 were made 2,423 members over the period 1916-930, the average per member being ,506. Since 1926 the average loan has sen to $5,973, and the number of loans r year during the last 5 years averaged 42. A large part of the 1930 loans was laced in Akershus Province where pro-uctive forest, according to Zon and Spar-awk (Forest Resources of the World, ol. I, p. 253) forms over half the total ea, and half of the forest area is in nall private holdings.

Comparison of paid up and outstand-g loans reveals the healthy condition of e Society. From 1916-1930, 365 loans, ggregating $2,106,303 were paid back. 1926, $176,976 was returned, and in 930, $323,975. Loans outstanding in 930 totalled $8,813,944, an increase of 2,204,657 over 1926.

BOND ISSUES

The financial market is very favorably isposed towards the Society's bonds. In act, the market expanded so rapidly in e latter part of 1930 that the bond sup-ly was unable to satisfy the effective de-and. Bond sales from 1916 to 1930 in-lusive amounted to $11,289,240, or about 400,000 more than the aggregate of all oans made. The average yearly issue was 752,628, and the corresponding amortiza-ion is 20 per cent of that amount.

RESERVE FUNDS

Increasing reserve funds are another in-ication of progress. From $9,380 in 1916 the reserves rose to $217,080 in 1926 and to $281,485 in 1930. Payments to paid-up members from the fund for the 10 years ending in 1926 averaged $742, the annual payments increasing to $1,499 by 1930.

PROFIT AND LOSS

The Society reports a successful year for 1930. As in the preceding year, loans averaged 33.2 per cent of the valuation of the security. Surplus available for disposal was $20,161, half of which was transferred to the reserve and administration funds. Incidentally, part of the surplus is to be used to provide fellowships to young farmers for practical study at home and abroad.

Losses sustained in 1930 from unpaid debts were $8,411. Unpaid interest at the end of the year was $108,302, of which only 2 per cent was due prior to 1930. The 24 properties foreclosed for debts aggregating $105,867 are to be sold.

Credit Possibilities of American Farm Woodlands

Coöperative credit has operated successfully in Norway. Perhaps after the spirit of coöperation is as firmly ingrained in our farmers as it is in the Norwegian, they may be ready to handle their own credit needs. Meanwhile, existing facilities, particularly the Federal Land Banks, Joint Stock Land Banks and Intermediate Credit Banks are quite ample from that standpoint. It is noteworthy that the farm woodlot in Norway *actually forms a part of the total farm credit base* whereas in this country the woodlot has no loan value whatever.

Although the growing need of American farmers for coöperative production and distribution of forest products has generally been recognized by research and

[3]Norges Kreditforening for Land-Og-Skogbruk, 1930. Oslo, Norway.

extension workers, the loan value possibilities of the farm woodland have been ignored. Inasmuch as the woodland is part of the agricultural enterprise, it should be an element in the determination of the total loan value. That it has not been in the past is no reason for believing that it may never be. When we consider that around 125 million acres of our productive forest area is in farm ownership, its potentialities as a basis for credit loom up.

Assuming an annual average net income from the woodland of $1 an acre and interest at 5 per cent, the possible loan value, at one-third of the capitalized value is roughly $800,000. Under present conditions, however, this figure is undoubtedly much too high. For reasons of security loans would probably be restricted to tracts containing timber now merchantable or nearly so. Thus, for all practical purposes the above figure would have to be reduced considerably. Perhaps $125-150 million would be nearer the truth. Even so, this is a significant amount.

The main difficulty in the security question revolves about the problem of management. But this is no insurmountable obstacle. Many banks in making farm loans stipulate certain minimum requirements. Soil fertility must be maintained by crop rotation, erosion prevented, and improvements kept up. The Federal Land Bank of Houston, Texas, for example, will not grant a loan to a farmer unless the farm is free from erosion. It also maintains an erosion expert to help the farmer keep his land at its maximum productivity.[4]

The same idea could be applied to the woodland. Locally determined minimum requirements, enforceable by the local loan committees, could easily be established after consultation with the extension forester and research agency. If the woodland area was large enough to wa rant it, a forestry expert might also employed by the credit agency to ass the farmers in improving their cutting a marketing practices.

Whether the farmers would be willi to submit to limitations in the utilizati of their timber is still another matt Probably the possessor of a small acrea would not consider the incentive sufficie But there are many sections where t farm woodland is important both for area and for the income it yields. Mo over, it must not be overlooked that, oth things being equal, the farmer who ut izes his own forest products for domes purposes merely at the expense of spa time labor usually has a larger cash come and is a better credit risk than t one who neglects the opportunities offer by his timber tract and expends cash f many products that his own land cou yield.

It is here that efforts should first made to determine how credit facilit may soundly be extended. The assuran that his timber would have an apprecial loan value if properly handled should e courage an owner to view the practice forestry in a more favorable light.

The returns from the forest produ would help him liquidate the loan up the farm as a whole; or upon the woo land alone in case he had borrowed up that portion of the farm only. There no doubt that farm forest products ge erally have a good market. The Cens of Agriculture for 1930 (second serie shows that in 1929 the total value of "f est products cut on farms for home u and sale," was about $244,000,000. C responding values for 1899, 1909, a 1919 are $110,000,000, $195,000,000 a $394,000,000 (increase due in part to flated prices) respectively. It is al

[4]Van Hise and Havemeyer. Conservation of our natural resources. 1930. P. 376.

rth noting that in 1924 farmers expended nearly $167,000,000 for lumber, posts, ewood, etc. These returns definitely ich the fact that the wooded portion of e farm has considerable value. That its come producing capacity has not been preciated sufficiently heretofore may be attributed to the general unconcern, concomitant with an expanding agriculture, over the question of forest land utilization. It is quite likely that as the present trend in the opposite direction becomes more evident, a more wholesome interest will develop in this neglected farm asset.

The conservation movement has not arisen from any desire to block the settlement of the West. It has not arisen in the minds of any of its most enthusiastic supporters from a desire to delay, annoy, or irritate settlers in securing homes. The whole purpose of this movement was to arrest a tendency in the direction of monopolistic control of the natural resources in coal, in timber, and in water power. It was the declared purpose of the men who were advancing this movement to save the public domain for home-seekers and to protect the domain upon which they were to make their homes from monopolistic control.

From *The Public Papers of Francis G. Newlands* by Arthur B. Darling. 1932.

FOREST ECONOMICS: WITH SPECIAL REFERENCE TO STUMPAGE, LOG, AND LUMBER PRICES[1]

By HENRY B. STEER

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The author emphasizes the importance of forest economics, enumerates some of the federal research projects in forest economics now under way and graphically presents the general downward trend since 1923 in stumpage, log and lumber prices. A number of illuminating graphs on price trends are appended.

IT WOULD BE obviously impossible, in a paper of this length, to cover adequately and thoroughly the field of forest economics and its relationship to all phases of forestry endeavor, or to discuss in the amount of detail which their significance really warrants the more important forest economic studies now being prosecuted. I shall, therefore, attempt at this time only a very brief statement of what I believe to be the importance of forest economics in its relationship to general forestry in the broadest sense of the word and present a short enumeration in a most general way of some economic studies now being prosecuted by the Forest Service as interesting examples of possible and necessary lines of forest economic research.

Forestry has been defined as the science and art of managing forests in continuity for forest purposes. Forest economics may be defined as the science that investigates the economic conditions and laws affecting the production, distribution, and consumption of forest products. There can be no phase of forestry that does not have its economic aspects, and the application of forestry, and the formulation of forest policies, whether on or for public or private lands, should be guided largely by economic considerations. It is true that the economic aspects of those phases of forestry dealing with the production, distribution, and consumption of the more tangible products of the forest (lumber and other materials) have merited and will probably continue to merit the primary consideration of foresters. The feeling is perhaps growing, however, that the economic importance of those general phases of forestry having to do with the provision and maintenance of the more or less intangible benefits of forests to the whole body politic, such as the regulation of stream flow and erosion, the use of forests for recreation and game supply and for other social benefits, warrant considerably more investigation and study than has heretofore been made.

An almost indefinite list of economic uncertainties, problems, and objectives of forestry could be enumerated and discussed. Suffice it to say that sound forest economics should form a vital part of any forestry program, endeavor, or study. Especially is this true for recent years which have witnessed unparalleled economic disturbances and upheavals, necessitating adjustments in viewpoint and methods in the field of forestry as well as in practically all other lines of human endeavor. The need for a solid groundwork of economic knowledge has been brought home to foresters as an organization, in connection with recent policy-making efforts.

As examples of possible and necessary forest economic research activities, some of the projects of the Division of Forest

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[1]Presented at the annual meeting of the Allegheny Section of the Society of American Foresters, Baltimore, Maryland, February 26-27, 1932.

Economics of the Forest Service will be mentioned briefly.

1. The Forest Survey, a nation-wide investigation, which is designed to secure data on forest areas, volumes, growth conditions, depletion, and the present and prospective national needs for forest products, and such other facts as may be necessary in the determination of ways and means of balancing the timber budget of the United States.

2. The forest taxation inquiry which has as its major objective a thorough analysis of existing forest tax laws and the results of their application in the several states and regions.

3. The extensive project, to make available, pending the production of results from the Forest Survey, the best possible up-to-date data on the supply of timber; the rate of depletion of existing supplies by fire, insect damage, and legitimate use; the rate of growth of future supplies; and other pertinent information concerning the present forest situation.

4. The forest insurance investigation which has for its purpose the determination of sound principles and practicable methods of forest insurance, and to facilitate their adoption.

5. The investigation of the financial aspects of private forestry practice. This study is designed to provide authoritative information as to the trends of timber values, costs and returns of production, and other controlling factors.

6. A survey of the present status of private forestry and a thorough study of practical measures for speeding it up and for stopping devastation.

7. A series of individual studies of land use in relation to forestry.

8. Studies to determine what is happening to the vast acreage of privately owned denuded forest land which, as a consequence of the non-payment of taxes, is forming a new public domain.

9. Forest statistics, covering the collection and analysis of recent statistics as to the production, distribution, consumption, and value of lumber, pulpwood, and other forest products.

10. The collection, compilation, and analysis of stumpage, log, and lumber prices.

Research in forest economics is largely a fact finding activity. Although the results of any economic study may be subject to more or less varied interpretations, the careful and systematic assembling of pertinent economic data is the first essential for the intelligent consideration of any economic problem.

The enormous amount of competent and skilled statistical labor necessarily involved in the collection and compilation of basic data on any economic study is rarely evident in the final report and can hardly be realized until one is actually engaged in such a project. Because of it, however, results of economic studies can not be produced as rapidly as Model A Fords.

For several years the Division of Forest Economics has been collecting reports of private stumpage and log transactions. These reports have been collected through the coöperation of the Division of Manufactures of the Bureau of the Census. It is hoped that, when these data have been systematized and compiled for a number of years, interesting and valuable trends for the most important species of timber in the major forest regions of the country may be developed. These trends, if they can be established, will certainly be of value in the study of the financial aspects of forestry in years to come.

To date, the reports received for the eight-year period 1923 to 1930 have been compiled, and although this period of time when compared to an average period of rotation necessary for the production of salable products of the forest, is too short to show complete trends, yet it does reveal definite tendencies which are intensely interesting.

Before bringing out some of the high

points of this study, it would be well, perhaps, to mention one fact which should be borne in mind constantly. The consideration of price data for a period beginning with 1923 introduces an economic condition or fact which is apt to throw a monkey wrench into the gears of reasoning and deduction unless proper allowance for the unusual economic record of that year is made. Generally speaking the prices of lumber, as well as those of other basic commodities, have declined since 1923, and it is natural that stumpage and log prices should follow the price curve of all commodities. This condition must not be lost sight of.

Reports for the years 1923 to 1930, inclusive, have been compiled by states, regions, type of sale, and species, and, in the case of stumpage sales, involve an amount of timber well in excess of one hundred billion feet. The first interesting result of this study was the determination that less than 45 per cent of this large amount of privately owned timber has been sold in individual sales. According to the classification used in this study, an individual sale is one where only one species has been sold or where, if a tract contains two or more species, they have been sold at different prices. Flat-rate sales include those sales in which two or more species, of obviously varying worth, have been sold at a single rate per thousand feet, or where a timber tract as a whole has been sold for a lump sum. The practice of selling timber in flat-rate sales or for a lump sum is not limited to any section of the country but is widespread. Where it has been possible to make comparisons between individual and flat-rate sales in the same locality, such a comparison clearly discloses that timber owners who dispose of their timber in individual sales at prices approximating the relative value of the several species obtain a higher price for their timber than the owners who dispose of their timber in flat-rate or lump-sum sales. The same general situation exists with regard to log sales, although flat-rate or lump-sum sales of logs in states east of the Great Plains during the past eight years comprise only about 50 per cent of the total. If these data are correct, and it is believed that they do represent actual conditions, considerable improvement can be made in methods of selling both stumpage and logs, and such improved methods will result in higher returns to the producers. Although a great deal of work along these lines has been done in recent years by state, extension, and private foresters, an enlarged program of education along the lines of timber estimating and appraising, knowledge of the uses and value of the different species of timber, and merchandising methods appears to be warranted and would result in higher returns to the owners of timber tracts and those who cut their own timber and dispose of the logs.

Other interesting results of the compilation of the data for the eight-year period are the surprisingly small amount of second-growth timber (about 10 per cent) sold, the shift in sales of stumpage from the South and East to the West; and the relatively large amount (about 85 per cent) of the sales of logs primarily intended for the manufacture of lumber. These data present a picture of conditions based on what is believed to be the largest collection in existence of reports of actual sales. It is also interesting to note that in many instances second-growth timber sells for higher prices than virgin timber of the same species brings in the same region. Relative accessibility certainly has some bearing on this condition as it also must have on the fact that stumpage prices increase, other things being equal, as timber tracts are located closer to the centers of largest consumption of wood products. This statement opens up the whole question of the advisability and desirability, from the strict standpoint of financial returns, of greatly

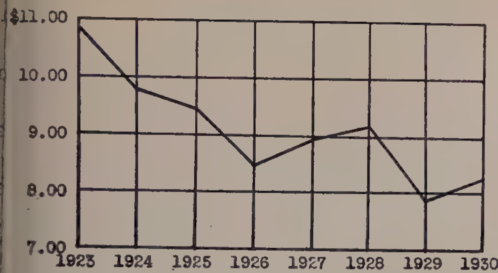

Fig. 1.—Stumpage prices, second growth northern white pine, New York and New England, 1923-1930. Average price per thousand feet. Basis 326,611,000 feet.

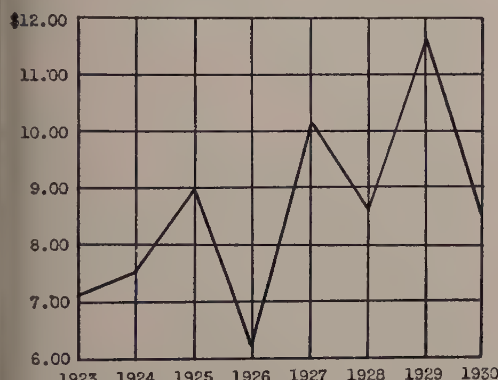

Fig. 2.—Stumpage prices, all growths oak central region, 1923-1930. Average price per thousand feet. Basis 282,681,000 feet.

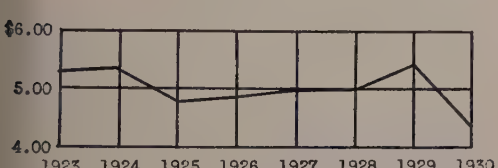

Fig. 3.—Stumpage prices, second growth southern yellow pine, North Carolina Pine Region, 1923-1930. Average price per thousand feet. Basis 1,000,870,000 feet.

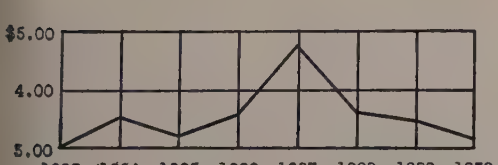

Fig. 4.—Stumpage prices, second growth southern yellow pine, southern pine region, 1923-1930. Average price per thousand feet. Basis 2,567,206,000 feet.

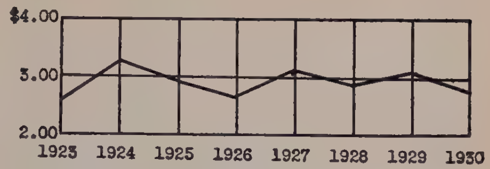

Fig. 5.—Stumpage prices, virgin Douglas fir, Pacific North, 1923-1930. Average price per thousand feet. Basis 9,221,485,000 feet.

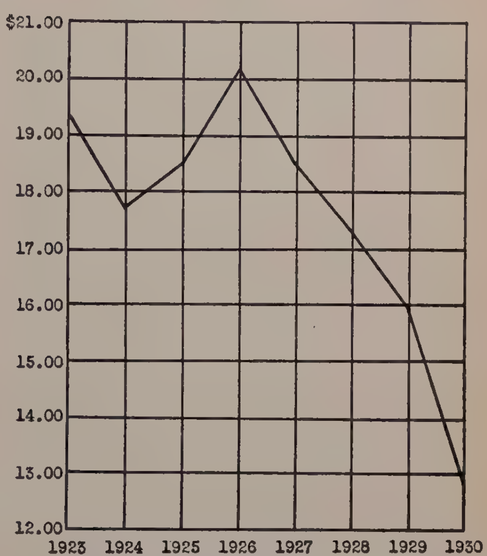

Fig. 6.—Log prices, box shook logs, Northern White Pine, New York and New England, 1923-1930. Average price per 1,000 feet. Basis 70,627,000 feet.

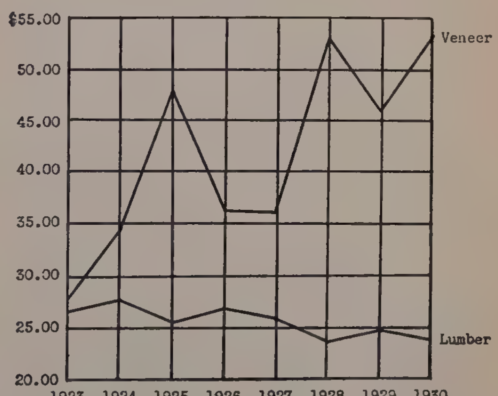

Fig. 7.—Log prices, lumber and veneer logs, maple, Lake States, 1923-1930. Average prices per thousand feet. Basis, lumber 530,512,000 feet, veneer 21,578,000 feet.

increased protection and reforestation programs in those regions which have practically exhausted their original supplies of timber and are now dependent upon imports from other regions or countries for the necessary supplies of wood products and for the continuation of industries which are of great importance in the economic life of whole communities.

According to the data analyzed, there has been, generally speaking, a decline in both stumpage and log prices during the eight-year period 1923 to 1930 in the country as a whole. This general observation was indicated by a comparison of the prices received for the individual sales of the several species as reported for each of the eight years with each species weighted, in determining the general average, by the amount of that species reported sold. Considerable variation in the general trend is noted when regions and individual species, especially hardwoods, are considered separately. Notwithstanding the general downward trend, there has been a marked upward trend in the prices of hardwood stumpage in the central region, second-growth southern yellow pine in the South, and some southern hardwoods. I believe that the addition of more years prior to 1923 to the eight years now being considered will tend to make this upward trend even more marked. The price levels of both hardwood stumpage and logs have not only been more nearly maintained with relation to the 1923 levels than have those of softwoods, but in some instances hardwood prices have increased. The general uses of softwoods and hardwoods and the consideration of supply versus demand, offer a reasonable and plausible explanation. The larger part of the softwoods are used for building and general construction. The eastern softwoods have been thrown into direct competition with the remaining huge reservoirs of western virgin softwoods, and a decline in prices due in part at least to overproduction in the west, and to the reduction in building and general construction activities, has been inevitable. Hardwoods, on the other hand, are in much greater demand for the manufacture of furniture and in other wood-using industries manufacturing specialized wood products than they are for building and structural purposes. According to the latest available information there has been an increased output of hardwood products, which means an increased demand in the period under consideration. Having no vast supply of western hardwoods[2] to fall back on, this demand has been met from the eastern, southern, and central stocks of hardwood timber, which are certainly not increasing. It is expected that information along this line, which has been collected in connection with the extensive revision project, will be available in the near future. It is interesting to note, however, that those price trends, developed to date by the stumpage and log price project, appear now to act as one would reasonably expect them to act in view of changes in recent years in the existing supplies of timber in the several regions and of the different species, and changes in demand, production, and consumption. Reports for the years 1900 to 1922, although not as numerous as those for the most recent years, are being compiled and analyzed as fast as the available funds and personnel will permit. It is hoped that results for the entire period from 1900 to 1930 will be available in the near future.

In connection with the main stumpage and log price project, studies to determine, according to the most up-to-date statistical methods, the effect of certain factors on stumpage prices, were made. One hundred and twenty-three reports of sales

[2]Editors Note: The substantial importation of hardwoods from the Philippines and its steady increase bears an important relation to the drain of hardwoods from eastern and southern forests and must be reckoned with.

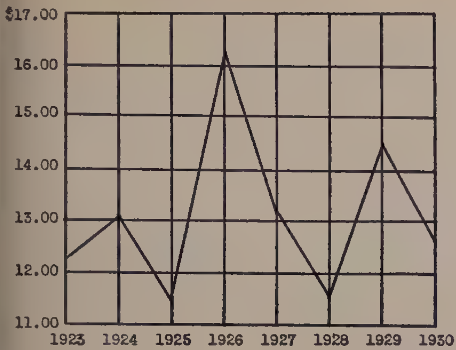

FIG. 8.—Log prices, lumber logs, southern yellow pine, southern pine region, 1923-1930. Average price per thousand feet. Basis 2,144,071,000 feet.

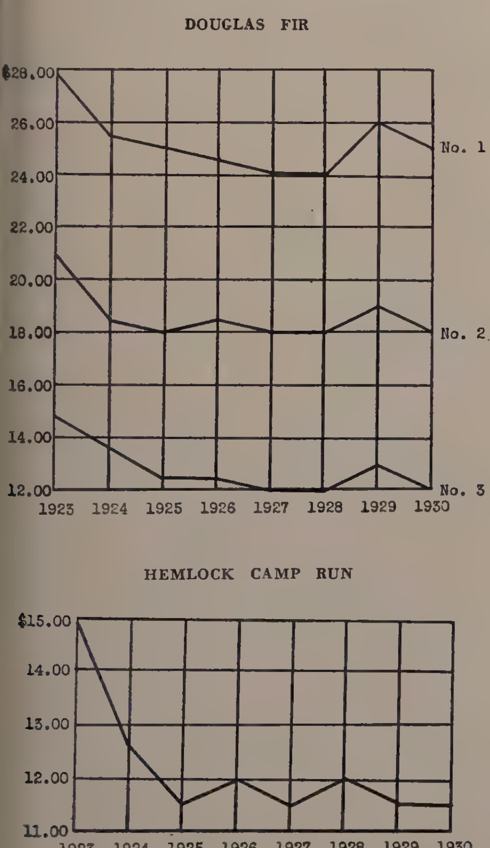

FIG. 9.—Log prices, Puget Sound, Washington, 1923-1930—U. S. Forest Service, Portland. Average Price per thousand feet.

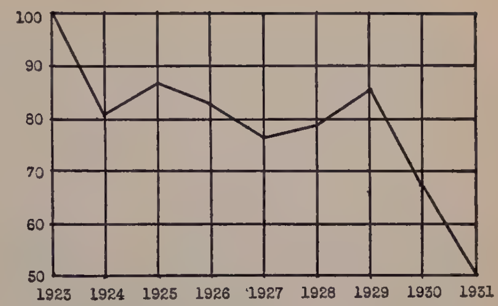

FIG. 10.—F.O.B. mill prices—U. S. Dept. of Labor, Douglas fir, common sheathing and drop siding. 1923-1931. 1923=100 per cent.

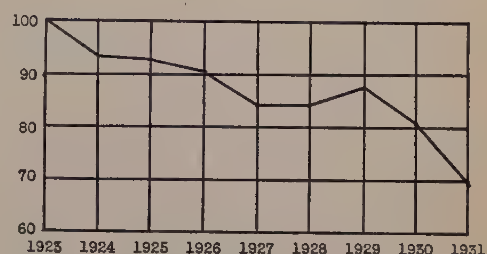

FIG. 11.—Wholesale prices—U. S. Dept. of Labor. All building materials, 1923-1931. 1923=100 per cent.

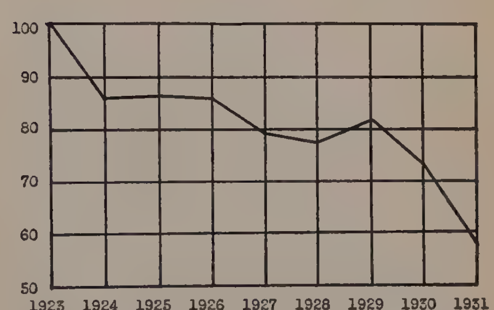

FIG. 12.—Wholesale prices—U. S. Dept. of Labor. Lumber, 1923-1931. 1923=100 per cent.

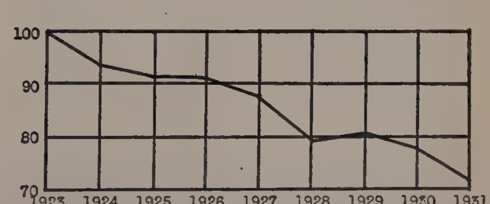

FIG. 13.—Retail lumber prices—U. S. Dept. of Commerce. 8 representative cities, 6 representative items, 1923-1931. 1923=100 per cent.

of stumpage, involving over 2 billion feet of timber in western Washington in 1929, were made the object of a multiple correlation problem to determine, by statistical methods, the effect of four independent variables on the price received (the dependent variable). Although many factors influenced the prices paid for stumpage in western Washington in 1929, it was possible, from the reports at hand, to study only four of them, namely, the size of the tract in acres, the distance from market or sawmills, the stand per acre, and the percentage of desirable species. (Hemlock and white fir were considered undesirable species, and Douglas fir, Sitka spruce, western red cedar, and western white pine, were considered desirable.) It was found that the four factors mentioned explained only 16 per cent of the variation in stumpage prices, leaving the balance, or 84 per cent of the variation to be explained by other factors which could not be studied. Although the results of this study appear to be largely negative at first thought, yet they are instructive. I believe most foresters, with a first hand knowledge of western Washington timber and with some experience in timber sale work in that locality, would hazard an opinion that the four factors mentioned would exert an influence greatly in excess of 16 per cent on the price paid for stumpage in 1929. If the results of this study are correct, the more intangible factors which can not be expressed mathematically such as competition, necessity for sale or purchase, quantity of timber available for purchase, and knowledge of values on the part of both purchaser and seller, exert a much greater influence on the price paid for standing timber than the four factors mentioned. 1930 sales from western Washington were studied in a similar manner, although in more detail in that the size of the universe was reduced. Separate problems were worked for the Puget Sound, Grays Harbor, and Columbia River regions; for second-growth Douglas fir; and for sales or purchases made by large timber holding or manufacturing concerns. The results were about the same as those obtained from the study of the 1929 sales. These studies are mentioned mainly as interesting examples of research in stumpage and log-price data. I should perhaps mention that they were prosecuted under the guidance of statisticians of the Department of Agriculture, and as far as I know are the first efforts along these lines.

It will be noted that lumber prices are conspicuous in this paper by their absence. In my rather limited experience, I have found that when you begin to deal with lumber prices, especially retail prices, you are "monkeying with a buzz saw." Time will not permit me to dwell on the subject at any great length although I should perhaps state that the Forest Service has considerable information on lumber prices which it is planned to systematize and compile as soon as possible. The greatest difficulty appears to be the lack of continuity of records, particularly with regard to grades, and the seemingly virtual impossibility of tracing items and accounting for costs from the producer to the ultimate consumer.

SAWMILL WASTE AND ITS UTILIZATION IN SCANDINAVIA AND THE PACIFIC NORTHWEST[1]

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The percentage of sawdust is smaller in Scandinavian than in West Coast sawmills, but the percentage of slabs, edgings and trimmings is greater. West Coast mills obtain higher lumber yields than the European mills. Sweden uses 18 per cent of the log for pulp chips; the West Coast only from 2 to 4 per cent. Other interesting and useful comparisons are made by the author. They indicate the lines along which improvement may be possible in American log utilization.

RECENT PUBLICATION of A. H. Hodgson's[2] report entitled *Sawmill Waste and Its Present Utilization in the Douglas Fir Region* permits the comparison of conditions in the Pacific Northwest with those in other portions of the world. There has long been at least a feeling that the United States, and the West Coast in particular, have been much more wasteful than have European countries in its sawmill operation. Consequently an attempt has been made to compare the percentage of mill waste and the extent of its utilization in Oregon and Washington on one hand with that in British Columbia, Sweden, and Finland on the other.

The data for the Douglas fir region were secured from Hodgson's report, and for the other countries from the references given as footnotes in Table 1. All of the studies reviewed were undertaken between 1926 and 1929. Hence they can be compared without consideration of economic conditions other than the differences which normally exist between the countries.

In order to make comparisons between items as nearly similar as possible, it has been necessary to recompute some of the percentages in each case. Some assumptions, as indicated in the tables, have also been advisable. In every case these recomputations and assumptions have resulted either from the different presentation followed in the individual reports or because certain reports did not cover the field as thoroughly as did others. Every effort has been made to understand the original author's interpretation under these conditions.

A comparison of the percentages of the log converted into lumber, sawdust and slabs is presented in Table 1. The percentages of the different classes of material for Oregon and Washington are based both upon the volume of wood contained in the logs sawn, and upon the volume of wood and bark together. This was possible because adequate figures were given for both bark and wood. Since the timber of the coast region of British Columbia is so similar to that of the Douglas fir region of the United States, it seemed logical to add to the Canadian figures a bark percentage equal to that given by Hodgson for Oregon and Washington and then recompute the percentage of the various items using this new total volume as a base. For lack of better converting factors the same percentage allowance was made for the interior mills.

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[1]The author wishes to express his appreciation to members of the staff of the Canadian Forest Products Laboratory for helpful suggestions and criticisms.

[2]In The Timberman, Vol. 32, No. 9-12, 1931.

There is no way of telling whether the percentages used in the Finnish and Swedish studies were based upon the volume of wood in the log or upon the volume of the wood and bark together. The latter appears to be the case.

In both Finland and Sweden allowances were made for "shrinkage." It is assumed that this is the loss in lumber volume during drying and has been included in the rough green lumber volume for these two countries. There is a possibility, however, that "shrinkage" might mean the discrepancy between the volume of the log and the measured or computed volume of the products. If this is true, the percentage of rough green lumber would be less than indicated in Table 1, while the slab and sawdust percentages would be correspondingly higher.

A comparison of the percentage of the log volume converted into sawdust shows Sweden to be low with 10 per cent, the coast mills of British Columbia high with 17.2 per cent, and the Douglas fir region of Oregon and Washington about midway with 13.7 per cent. It appears as though these differences might be attributed to the type of saws. Sweden uses gang saws with a narrow kerf, and British Columbia has a higher proportion of circular saws with a wide kerf and a consequently larger percentage of sawdust. This, however, does not explain why Finland, using gang saws, converts a higher percentage of the log into sawdust than does the Douglas fir region.

The percentage of the log converted into slabs, trimmings, and edging is least in British Columbia, greatest in Sweden and Finland, and intermediate in Oregon and Washington. There is no apparent reason for the difference of nearly five and one-half per cent between British Columbia and the Douglas fir region of the United States. The higher yield of slab in Sweden and Finland might be attributed to the smaller logs and the larger

Table 1

PERCENTAGE OF LOG CONVERTED INTO LUMBER, SAWDUST AND SLAB

Item	Douglas fir region of Oregon and Washington[1]		Sweden[2]	Finland[3]	British Columbia[4]			
	Based on wood volume	Based on wood and bark volume			Based on wood volume		Based on wood and bark volume[5]	
					Coast mills	Interior mills	Coast mills	Interior mills
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Lumber (rough green)	66.6	59.3	54.0[6]	52.4[7]	68.9	67.5	61.3	60.1
Slabs, edgings, trimmings	19.3	27.0	36.0	33.4	13.9	16.4	22.2	24.4
Sawdust	14.1	13.7	10.0	14.2	17.2	16.1	16.5	15.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1]From "Sawmill Waste and Its Present Utilization in the Douglas Fir Region of Oregon and Washington." A. H. Hodgson. Timberman, Vol. XXXII, Nos. 9 to 12, 1931.
[2]From Härlin and Lundberg as quoted by Levan (See No. 3).
[3]From "Sahateollisuuden jätepun ja sen käyttö." M. Levan Metsätieteelisen Futkimuslaitoksen julkaisuja, Helsinki, 1931.
[4]From "Sawmill Waste and Its Utilization in British Columbia." J. H. Jenkins. Canada Dept. Interior. Forest Service Bul. 83, 1931.
[5]Recomputed after inserting the same percentage of bark given by Hodgson.
[6]Includes [illegible]
[7][illegible]

proportion of top logs sawed. Small logs yield a lower percentage of their volume in lumber and a higher proportion in slab. The same is true of top logs because of their greater taper. But the fact that the European countries produce a larger proportion of one-inch stock, as compared to the Douglas fir region, should tend to offset this.

The percentage yield of lumber is highest in British Columbia, least in Europe, and intermediate in Oregon and Washington. Again there appears to be no reason for the 2.3 per cent greater yield in the coast region of British Columbia. The uniformly lower yields in the Scandinavian countries might be attributed to the smaller logs and to the larger proportion of top logs.

But only a portion of the story is told unless the disposal of the slab and sawdust is considered. This has been much more difficult because of the lack of detail, especially in the Scandinavian reports. Similarly, no figures are available as to the disposal of the sawdust in British Columbia. However, it was assumed that in British Columbia the same percentage of the log was used for mill fuel as was reported in Oregon and Washington. Thus 11.7 per cent of the total log volume was deducted from the slabwood and sawdust not reported as utilized. The remainder was then considered as unutilized waste and was classified as destroyed in the refuse burner.

By reference to Table 2 it is evident that in the Douglas fir region of Oregon and Washington, a smaller percentage of the log volume is converted into what might be called "smaller lumber." Only 1 per cent of the total volume is remanufactured into lath, handle squares, and shingle bands. Finland uses 4.4 per cent of the log volume in this way, and Sweden and British Columbia 3 per cent. It is noted that in the southern interior region of British Columbia snow fencing and car door stock are produced from slabs. These larger pieces can be produced with less loss of stock than can lath, shingle bands and handle squares. This supports the idea that the production of small dimension stock from fir mill waste in Oregon and Washington would result in a greater utilization of the log.

There is little difference in the percentage of the log converted into pulp chips between British Columbia, the Pacific Northwest, and Finland. Sweden, however, reports 18 per cent for this purpose as contrasted to between 2 and 4 per cent for the other countries. The fact that Swedish mills do convert so much of their waste into pulp material indicates that the American mills have not yet exhausted the possibilities in this field. It might be argued that, since Douglas fir, which is in less demand for paper making, makes up such a high proportion of the mill waste in British Columbia and in Oregon and Washington, utilization could not be expected to be so complete as in regions cutting largely species suitable for pulp. But reports from hemlock mills in both Canada and the Pacific Northwest show that none of them are approaching the Scandinavian mills in this respect.

The amount of mill waste disposed of as fuel seems to depend entirely upon the proximity of the mills to centers of population. This is illustrated by the 8 per cent greater production of fuelwood in the Pacific Northwest as compared to British Columbia. Finland converts a larger portion of the mill waste into fuelwood than does any of the other countries. This seems to be at the expense of pulping material and also includes material similar to that sent to the burner in America.

The data are neither sufficient nor definite enough to compare the percentage of the log destroyed in the burner. It is obvious, though, that a much larger propor-

tion is unutilized in America than in Europe.

The main points in this comparison of American and Scandinavian conditions appear to be (1) that between three and four times as much material is nonutilized in America, (2) that a greater, and perhaps better, use could be made of western slab wood by converting it into short-length lumber and small dimension stock, and (3) that there is still further need for developing the production of raw material for pulp plants from American sawmill waste. Once cognizant of the possibilities of reducing the unutilized portion of the log, there seems to be no doubt but that the American mill operator will take advantage of them. Intensive research by the industry would undoubtedly disclose new and more profitable outlets for these waste products. In lieu of such research, only a marked and unexpected change in economic conditions will permit handling them at a profit.

TABLE 2

DISPOSAL OF SLABS AND SAWDUST BY PERCENTAGE OF TOTAL LOG VOLUME

Item	Douglas fir region of Oregon & Washington	Sweden	Finland	British Columbia[8]
	Per cent	Per cent	Per cent	Per cent
Lath	0.8	3.0[1] (Lath, Handle squares, Shingle bands)	4.4[2]	3.0[4]
Handle squares	0.1			
Shingle bands	less than 0.1			
Pulpwood	1.2	18.0 (Pulpwood, Pulp chips)	3.8	2.0
Pulp chips	1.3			
Fuelwood (sold)	8.6	3.0[3]	—	—
Hogged fuel (sold)	4.5	—	33.6[7]	5.1
Sawdust (sold)	1.4	10.0[6]	—	—
Fuel used in mill	11.7	—	—	11.7[5]
Charcoal	—	—	0.8	—
Other uses	—	—	0.3	—
Other waste	—	12.0	—	—
Burned as refuse	11.1	—	4.7	15.6
Totals	40.7	46.0	47.6	37.4

[1]Reported as lath and staves.
[2]Reported as splitwood.
[3]Reported as small or short lumber.
[4]Includes lath, shingle bands, snow fencing and grain car door stock, but no handle squares.
[5]Assumed percentage same as in Douglas fir region.
[6]Disposal of sawdust not reported.
[7]It is not evident from the report whether this figure is for fuelwood sold or includes also that used in the mill.
[8]Weighted average of coast and interior mills.

BRIEFER ARTICLES AND NOTES

Germinative Capacity of Seed Produced From Young Trees

Production of cones (seed) early in the life of forest trees is important in silvicultural practice. At just what time the trees in a stand will begin reproducing themselves becomes particularly important when the original stocking is inadequate. For example, in north Idaho there are hundreds of thousands of burned over acres that have natural reproduction of desirable species but not in the density desired by foresters for complete utilization of the site and the best development of the stand. Should this light stocking be augmented by planting additional trees? To do so would require a tremendously larger planting appropriation than is used at present. There are also hundreds of thousands of acres completely denuded by repeated fires. Such areas are being hand planted to re-establish tree growth. Here again sparse stocking often results; sometimes only 100 trees surviving, of the 680 trees originally planted. Should such areas be replanted when to do so would certainly be delaying the time when other areas having no tree establishment could be planted; and possibly, as this article later purports to show, be unnecessary?

In recent years, an unusual number of new one- and two-year-old seedlings has appeared on the white pine sites swept by the fire of 1910. The original stand of reproduction resulting after the fire was practically established in three years. The trees are from 6 to 20 feet high. Little additional reproduction appeared from about 1915 to 1925. From where have the new seedlings come? Apparently, from the first cones which the 1910 reproduction is now bearing.

Casual observations made over a long period show the following species bearing cones as early as the ages indicated below:

Pinus monticola	10 years
Pinus ponderosa	14 years
Pinus contorta	5 years
Picea engelmanni	16 years
Larix occidentalis	16 years
Thuya plicata	16 years

Except *Pinus ponderosa* all of these species commonly bear cones while in the 0-20 age class. Rarely does the ponderosa pine bear cones until past 20 years of age.

Although the seed yield per cone is less from these young trees, its viability appears to be equal to that of the seed produced by older trees.

Tests of 600 seeds each of seven lots of *Pinus monticola* seed from trees 10 to 17 years of age gave an average of 39 per cent germination. Two lots from 21- and 26-year-old trees averaged 55 per cent. Seeds collected in large quantities from trees 60 years and over and machine graded to remove hollow and light seed, averaged 54.5 per cent germination.

Ponderosa pine seed from 14-year-old trees gave 81 per cent germination, 0-20 gave 70 per cent, 21-40 gave 92.5 per cent, and 61-80 gave 66 per cent.

D. S. Olson,
U. S. Forest Service,
Missoula, Mont.

Growth and Mortality of Chestnut Sprouts

Soon after the chestnut blight became firmly established in this country and the futility of attempting to control the disease was apparent serious questions arose as to the future source of raw materials used in the production of chestnut extract. It was suggested by some manufacturers and users of tannin extracts that if all except the most vigorous sprout were removed from the base of a chestnut tree or stump, such a sprout might grow more rapidly than if it had to suffer the competition of the others, and might reach a size where it could be used for the production of extract before it succumbed to the blight. Although desirable results from this method seemed improbable, the Division of Forest Pathology, Bureau of Plant Industry, agreed to establish a small experiment to test the practicability of the idea.

In May, 1927, 200 chestnut stumps were taken at random on a north slope in the Bent Creek Experimental Forest near Asheville, N. C. The chestnut trees had been removed from the area earlier in the spring and the sprout growth was approximately one foot high. All except the single most vigorous sprout were removed from each of 100 stumps three times in 1927, twice in 1928, and once in 1929. The remaining 100 stumps served as checks from which no sprouts were removed.

Periodic examinations were made and records taken on height, diameter, and mortality from blight and other causes. Only the dominant individuals were considered in measuring growth of multiple sprout clusters and only a single average dominant was actually measured. Diameters were taken at 3 inches above the base.

Final measurements at the end of 4 years indicate that the removal of all except one sprout from a stump did not appreciably stimulate the growth of the remaining sprout. In 1927, when the experiment was started, the average height of the average dominants in the sprout clusters was 0.8 of a foot. By June, 1931, the average dominants in the sprout clusters were 13.26 feet high, while the average height of the single sprouts that remained alive was 13.5 feet. The average diameters at 3 inches above the base, in 1931, were 1.32 and 2.11 inches, respectively. An error in diameter measurements was introduced by the chestnut blight. The bases of most of the single sprouts were infested and the swellings caused by the invasion of the fungus considerably increased the diameter. Diameter measurements, if taken at breast height, would probably show very little difference between single, and the largest of the multiple sprouts, but there are so few living single sprouts remaining that such a comparison cannot be made.

The following table gives the per cent mortality of single sprouts from the blight:

Month	Per cent mortality
May 1927	0
June 1927	0
August 1927	0
May 1928	1
August 1928	11
August 1929	27
August 1931	88

In August, 1931, but 8 single sprouts remained alive. All were infected and will probably succumb during the year. No attempt was made to record mortality in multiple sprout clusters. During the first few years of growth single sprouts are very susceptible to mechanical injury as well as to blight. Browsing by deer and breakage due to a number of causes accounted for the discarding of 32 of the original 100. Of the remaining 68, 88 per cent had been killed by the blight by the end of 4 years. In no case

had the blight destroyed all individuals in a sprout cluster.

Thus, the evidence from this very limited experiment indicates that the removal of all except one sprout from a chestnut stump will not appreciably stimulate the growth of the remaining sprout. Furthermore, at the present rate of mortality from the chestnut blight in this region such single sprouts will not reach sufficient size so that they can be used profitably for the production of chestnut extract.

RALPH M. NELSON,
Appalachian Forest Experiment Station.

BISEXUAL FLOWERS AMONG THE PINES

The flowers (strobili) of the Pinaceae are normally unisexual, being either male or female, as distinguished from the flower of the typical angiosperm, which is bisexual or perfect. Occasionally, however, bisexual flowers are found among the Pinaceae; but such occurrences evidently are very rare. Coulter and Chamberlain, in *Morphology of Gymnosperms,* rev. ed. pp. 238-239, note that, among the Pinaceae, bisexual flowers have been reported for *Picea excelsa, Pinus maritima, Abies sp., Pseudotsuga douglassii, Sequoia* and *Juniperus communis.* Bisexual flowers were found last spring on lateral shoots of a seven year old *Pinus densiflora* (Japanese red pine) and a *Pinus massoniana* (Masson Pine) of the same age, growing in the arboretum of the Institute of Forest Genetics at Placerville, California. The flowers were similar in form to that of the bisexual flower of *Pinus maritima,* which is illustrated and described by Coulter and Chamberlain. The basal half of the strobilus in each case was male, resembling half of a normal pollen catkin; the terminal half was female, resembling a normal ovulate flower. The Japanese red pine that bore these flowers produced unisexual flowers abundantly also, the same shoot bearing separately both male and female flowers as well as the bisexual form. No other ovulate flowers were found on the Masson pine.

FIG. 1.—Bisexual flowers on Japanese red pine *(Pinus densiflora)* indicated by arrows.

Several of these abnormal strobili were left on each tree, and in each instance the pollen was shed, and the ovulate part enlarged somewhat, taking the form of a typical conelet with this difference, that the stalks are longer and the conelets are shorter than their normal counterparts usually are.

F. I. RIGHTER,
Institute of Forest Genetics.

MEMORIAL UNVEILED TO FIRST PROFESSOR OF FORESTRY IN MICHIGAN

Before a large gathering of alumni and officials, a memorial tablet was dedicated to the late Doctor William James Beal in the Pinetum of Michigan State College at East

Lansing, Michigan, on June 11. The memorial is a large field stone bearing a bronze tablet containing the likeness of Doctor Beal and the following legend:

> William James Beal — Professor of Botany and Forestry, 1870-1916 — "Father of Michigan Forestry" — Planted this Pinetum in 1896—placed in His Memory by 1911 Foresters — "Keep on Squintin'"

Many of the foresters of the class of 1911 who gave the memorial were present and participated in the exercises. Unfortunately, G. H. Collingwood, Forester of the American Forestry Association and the member of that class who originally suggested the memorial, could not be present. C. W. McKibbin, formerly with the Forest Service in the southwest, was master of ceremonies. H. E. Wales, Assistant Regional Forester of the U. S. Forest Service at Milwaukee, and F. E. Wilson, Chief Forest Fire Warden of Wisconsin, gave short talks, and Harry Lee Baker, State Forester of Florida, delivered the presentation address and unveiled the tablet. It was accepted by President Shaw of the college in behalf of the institution, who during his address suggested that henceforth the Pinetum be known as the Beal Pinetum. Mrs. Ray Stannard Baker, daughter of the late Doctor Beal, accepted the memorial in behalf of the family.

The trees now have an average height of 60 feet and breast-high diameter of 10 inches.

National Forest Receipts Decline

Receipts of the national forests for the fiscal year ending June 30 dropped to less than half the figure of the preceding year, announces the U. S. Department of Agriculture. The receipts, the Forest Service reported, derived from timber sales, grazing fees, and other uses, totaled $2,294,247 for the fiscal year 1932. They amounted to $4,993,320 in 1931 and $6,751,553 in 1930.

Water power rentals were the only large source of national forest income which showed a gain for the year. Receipts from this source were $116,352, as against $112,307 for 1931. Timber trespass settlements increased $1,000. Special use permits for hotels, summer homes, and resorts brought in $293,157, a decline of only $8,555.

The biggest drop was in timber sales, from $2,515,052 last year to $1,023,777 in the fiscal year 1932. The production of lumber was greatly reduced throughout the country, and many mills which ordinarily obtain their logs from the national forests were closed or were operated only part time.

A reduction in grazing fees as an emergency relief measure for livestock producers also accounted for a part of the decline in receipts. Fees for livestock grazing on the national forests were cut 50 per cent by order of the Secretary of Agriculture on February 24, 1932. The national forest ranges normally accommodate about 13,000,000 head of livestock for several months of the year. About 26,000 stock raisers hold grazing permits.

Table 1

NATIONAL FOREST INCOME SOURCES AND AMOUNTS FOR THE FISCAL YEARS 1931 AND 1932

Source	1932	1931
Timber sales	$1,023,777	$2,515,052
Forest products sales	7,449	
Timber settlement	2,932	68,093
Timber trespass	7,700	6,699
Turpentine sales	7,250	17,773
Grazing—cattle, horses	413,827	1,029,041
Grazing—sheep and goats	406,755	918,867
Grazing trespass	9,378	12,734
Special use	293,157	301,713
Occupancy trespass	160	938
Water power	116,352	112,308
Fire trespass	5,510	10,102
Total	$2,294,247	$4.993,320

In the Pacific Northwest, the Northern Rocky Mountain, the Rocky Mountain, and the Intermountain regions, decreases in na-

tional forests income exceeded 50 per cent. In California, there was a decline of $529,-926, or approximately 46 per cent. In New Mexico and Arizona, National Forest receipts decreased $138,798, or about 32 per cent.

In the eastern region, embracing national forests in the Eastern and Southern States, the receipts amounted to $91,173, as against $251,666 in 1931. The Lake States national forest region suffered a decline of $24,627, and the Alaska region $9,704.

British Foresters and the Economic Crisis

The economic crisis is falling with great severity on forestry, not only in the component parts of the British Empire, but almost the world over. Evidence of this state of affairs will be found in recent forest service reports, and is supplemented in more poignant detail by private advices. The imperative need for reducing public expenditure has had many repercussions in the forestry world. Funds set aside by statute for the development of forestry have been diverted to general revenue, while annual votes have been drastically cut. As a consequence of this lack of money administrative forest officers have been forced to abandon whole blocks of work, to dismiss trained staff, to reduce educational and research activities, and generally to countenance many things which are unpleasing to the keen professional man.

What can foresters do about it all beyond bowing to the inevitable and waiting for the blizzard to blow itself out? I believe we can do a number of useful things, and by so doing ultimately place forestry in a more secure position in national economics than it has yet occupied. May I suggest the following as worthy of consideration:

1. In the first place blizzards do not blow for ever, and in due course temperate weather will occur. The practice of forestry is essential to our civilization and must some day be resumed in full measure.

2. It is our duty to participate fully in the economy movement, not only by reducing expenditure but by redoubling our efforts at technical efficiency, so that such expenditure as remains is correspondingly effective.

3. If forestry has proved an easy subject for drastic cuts it is because it has not made sufficient friends. In other words, our educational effort has not yet borne the desired fruits. In this connection I call to mind a sapient remark made by Sir Francis Acland at the first Empire Forestry Conference in 1920: "No organic forestry laws, no dedication of forest reserves, no inalienable forestry funds will save a forest service in a time of trial if it has not got public opinion behind it through sound methods of education and publicity."

4. We can usefully review our policy, throwing overboard the "junk" which almost unconsciously accumulates, and fighting to the last ditch to keep the real essentials alive.

5. We can begin to think how the forestry machine can be better controlled so that the gradients of the road make it go neither too fast nor too slow for permanently good work.

I will not attempt to apply these five points to specific cases. The essentials for which we must fight have been discussed in detail at the three Empire Forestry Conferences and recorded in the Proceedings. Some of us were inclined to think, after the last Conference, that we had almost exhausted the usefulness of discussion on forest policy. It is clear, however, that we have not yet achieved the fundamental consideration, which has commonly been defined as "continuity". Apparently the word continuity requires further qualification. The crisis has shown us that continuity in scale is impossible of achieve-

ment. Can we accept and work successfully a policy based on continuity of outlook? This and allied questions will repay discussion when the foresters of the Empire again meet, as they are due to do in 1933.

Sir Roy L. Robinson,
in *Empire Forestry Journal*,
Vol. 10, No. 2. 1931.

The Timber Crisis and the World Economic Depression (A Polish Viewpoint)

"The current crisis in the timber industry has been caused by the existing disequilibrium between supply and demand, caused by the uneconomical exploitation of forest reserves (as in the United States) and by the excessive export of timber by such countries as the U. S. S. R.

"The various countries affected by the working of this crisis have endeavored to combat the evil results of this abnormal state by all the means at their disposal: they have restricted the home supply of timber, local restrictions in price have been arranged, the import of foreign timber has been held up by the imposition of customs duties, by increasing railway tariffs, whilst domestic production has been favored by reduced transport charges, lower taxation, credit aid, etc. In practice, however, all these measures, lacking coördination of method and time, have proved insufficient in order to obviate the fundamental cause of the crisis —the disproportion between world supply and demand.

"The restoration of equilibrium between supply and demand cannot be attained by enhancing the latter, since it is dependent only on the consumptive ability of the buying countries. The possibility of reducing the supply seems likewise to be a remote one; in theory, it should not be difficult to arrange for an understanding whereby the felling of timber would be reduced by voluntary restriction. But, however, the decisive voice would be that of the United States. Even the limitation of the solution of the problem to Europe alone would still leave a most difficult situation to handle with no chances of immediate success.

"It would appear, therefore, that the only means left is that of regulating the supply on an international scale by the help of the existing commercial system; precedents for this exist in the understandings attained in the sugar industry, in certain divisions of the heavy industries and in certain aspects of the recently examined conditions of the international corn market.

"This regulation could consist in the fixing of export quotas for the various countries exporting timber. It seems advisable for such regulation not to embrace the entirety of timber exports, but only its most important divisions, i.e., foreign trade in sawn coniferous timber; even the reform of conditions in this branch of the trade would not be an easy matter to settle in view of the very varied markets affected, the large number of grades of wood, the differing techniques of commerce in the various markets, etc. On the other hand, a regulation of the whole matter is much facilitated by the fact that any increment in timber which is in excess of the needs of the market need not be felled, and that the role of investment capital is, compared with the funds needed for turnover purposes, relatively insignificant.

"A most essential feature and condition for the inauguration of work in this direction is the establishment of national timber organizations, which could conclude understandings in the name of their member-firms and bind themselves to see to it that resolutions made by such mem-

bers be duly kept. At present, the only countries which can be stated to be in a position to conclude international understandings are Russia, Finland and the Scandinavian states. These countries possess strongly organized and disciplined export associations which are lacking in other centres, although an appropriate organization is in process of formation in Poland. There should not, however, be a single state exporting timber not possessing such an organization.

"Should this project become an accomplished fact, machinery will have been set up which will not only do much to weaken the force of the current crisis in the timber trade, but which will likewise be a potent factor in eliminating the possibility of similar crises in the future."

From *Drzewo Polskie*, (*The Polish Timber*), Warsaw, Poland.

Forest Radio

Field experiments in short-wave radio with portable sets are being conducted by the Forest Service in Oregon and Washington. Seventy-two sets are being used in the tests. Twelve sets are semi-portable radiophone or voice sets weighing 40 pounds each; and 60 are portable code sets weighing less than 10 pounds each. The semi-portable radiophone sets are for use at fire camps or lookouts; the portable code sets are for firemen going to fires, or small improvement crews in isolated locations. The radiophone set transmits both voice and code with a rated transmitting range of 20 miles code and 10 miles voice. The portable set receives voice and code, but transmits code only. Its rated transmitting range is 20 miles. Sets are being tried out on the Umpqua and Chelan national forests, with a view to their widespread adoption as they prove available.

World Forest Statistics

Forest statistics for 31 countries have been made available in pamphlet form by the Institute of International Agriculture. They are extracted from the International Yearbook of Agricultural Statistics 1930-31. Figures given include area covered by forest, stands of the important commercial species, lumber production, various classifications as to character of forest or ownership, etc. All descriptions are in French and English. The pamphlet was printed by the printing office of the Chamber of Deputies, Rome, Italy.

State Planting Exceeds Federal

More than 155,000 acres were planted to forest trees in the United States in 1931, according to a summary of state reports just compiled by the U. S. Forest Service. In 1930, 138,970 acres were planted.

More than 26,000 acres of the new planting was done by the Forest Service in national forests. Plantings in state forests totaled 58,989 acres, and forest plantings on other state lands, 3,321 acres. Reported planting by individuals amounted to 29,624 acres. Of the 16,940 individuals making forest plantings, all but 1,869 were farmers.

Industrial organizations, including pulp and paper, lumber, mining, railroad and water power companies, planted 21,638 acres, water power companies accounting for the largest share. Municipalities, by planting 11,561 acres, added 20 per cent to their previous plantings. Schools and colleges planted 1,114 acres, and other organizations 2,254 acres.

Michigan, as in 1930, led all states in planting and in putting idle lands back to work growing timber. Planting in Michigan by all agencies amounted to 47,264 acres, a gain of about 9,000 acres over

1930. New York was second, with 38,664 acres, nearly half being state lands. Pennsylvania was third with 17,825 acres, 13,-700 acres of which was private land owned by individuals and industrial organizations. Wisconsin's plantings amounted to 6,734 acres. Massachusetts planted 4,093 acres. Ohio, Nebraska, Washington, Montana, Idaho, Indiana, Louisiana, and Connecticut planted 2,000 to 3,500 acres each.

The 1931 plantings brought the total area of artificially reforested lands, recorded by the Forest Service, to 1,953,394 acres.

Vocational Forestry Training in Texas

Forestry will be taught in the vocational agricultural schools of east Texas under the Smith-Hughes Act beginning this fall, as a result of the interest and effort of the Texas Forest Service.

Norway Pine Volume Tables

Technical Note No. 43 of the Lake States Forest Experiment Station is a volume table recently prepared for Norway pine, from 198 trees measured in Vilas, Oneida, and Bayfield Counties, Wisconsin, based upon the Scribner Decimal C rule. The merchantable height of trees is given in number of 16.3-foot logs. It is interesting to note the values given in this table, compared with those for Norway pine appearing in Table 17, "Volume Tables for the Important Timber Trees of the United States—Part II, Eastern Conifers," published by the Forest Service in 1925, and based upon data collected by H. H. Chapman, E. S. Bruce, and T. S. Woolsey in 1913 in Beltrami, Cass, Hubbard, and Itasca Counties, Minnesota, and Bayfield County, Wisconsin. This latter table is based on the Scribner Decimal C rule, merchantable tree heights are given in number of 16-foot logs, and 4282 trees were measured.

There are 85 combinations of height and diameter common to the two tables. It is impossible to determine by inspection exactly how many trees entered into the computation of the data common to both tables, but it is cerain that not over 175 trees form the basis in the Lake States volume table, and not less than 2,500 trees are represented in the data from which Table 17 in the above named circular was constructed.

The aggregate difference in board foot volumes represented by heights and diameters common to the two tables is —7.1 per cent, based upon the values in Table 17. More careful analysis reveals that in the volumes for trees from 19 to 22 inches in diameter, there is an aggregate difference of —10.4 per cent, while in the volumes for trees from 8 to 1[illegible] inches, and from 8 to 13 inches, the aggregate differences are —2.9 per cent and —4.4 per cent, respectively.

This would indicate that the values for trees in the larger diameter classes in the Lake States table might be unusually low compared with the values given in Table 17, and may very probably be attributed to the relatively small number of trees upon which these values are based. There are about 4 per cent as many trees used for these larger diameters, in comparison with those used in Table 17; while in the smaller diameter classes, where the aggregate difference is considerably less, between 8 and 9 per cent as many trees were used, as in Table 17.

While no conclusions may be safely drawn from these comparisons, it is worth noting that very comparable results

have been obtained, at a much lower cost, in the construction of the Lake States volume table, and only where the number of trees used fell much below a reasonable limit is there a wide difference in results.

F. B. TRENK,
University of Wisconsin.

EARLY ENGLISH FORESTRY PROPOSALS

"Perhaps, it will be expected, that, before we begin to treat of the propagation of Timber, we should previously prove an approaching scarcity of that necessary article in this country: for it may be argued that every acre of land applied to the purposes of planting, is lost to those of agriculture; and, as far as culturable land goes, the argument is just. To speak of this subject, generally, as to the whole kingdom, and at the same time precisely, is perhaps what no man is prepared for.

"From an extensive knowledge of the different parts of the kingdom, we believe that the Nation has not yet experienced any real want of timber. We are happy to find that, in many parts of it, there are great quantities now standing; while, in many other parts, we are sorry to see an almost total nakedness. With respect to large well grown oak timber, such as is fit for the purposes of ship building, we believe there is a growing scarcity throughout the kingdom.

"We will explain ourselves, by speaking particularly as to one district—the vale of Pickering, in Yorkshire. This district, for ages past, has supplied, in a great measure, the ports of Whitby and Scarborough with ship timber. At present, notwithstanding the extensive tracts of woodlands still remaining, there is scarcely a tree left standing with a load of timber in it. Besides, the woods which now exist, have principally been raised from the stools of timber trees, formerly taken down; the saplings from which being numerous, they have drawn each other up slender, in the grove manner; and consequently never will be suitable to the more valuable purposes of the ship builder.

"When we consider the prodigious quantity of timber which is consumed in the construction of a large vessel, we feel a concern for the probable situation of this country at some future period. A seventy-four gun ship (we speak from good authority) swallows up three thousand loads of oak timber. A load of timber is fifty cubical feet; a ton, forty feet; consequently, a seventy-four gun ship takes 2,000 large well grown timber trees; namely, trees of nearly two tons each!

"The distance recommended, by authors, for planting trees in a Wood, in which Underwood is also propagated, is thirty feet or upwards. Supposing trees to stand at two rods (33 feet, the distance we recommend they should stand at, in such a plantation), each statute acre would contain 40 trees; consequently, the building of a seventy-four gun ship would clear, of such Woodland, the timber of 50 acres. Even supposing the trees to stand at one rod apart (a short distance for trees of the magnitude above-mentioned), she would clear twelve acres and a half; no inconsiderable plot of Woodland. When we consider the number of king's ships that have been built during the late wars, and the East Indiamen, merchants ships, colliers, and small craft, that are launched daily in the different ports of the kingdom, we are ready to tremble for the consequences. Nevertheless, there are men who treat the idea of an approaching scarcity as being chimerical; and, at present, we will hope that they have some foundation for their opinion, and that the day of want is not near. At some future

opportunity, we may endeavor to reduce to a degree of certainty, what at present is, in some measure, conjectural. The present state of this island with respect to ship timber is, to the community, a subject of the very first importance.

"However, in a work like the present, addressed to individuals, rather than to the nation at large, a true estimate of the general plenty or scarcity of timber is only important, as being instrumental in ascertaining the local plenty, or scarcity, which is likely to take place in the particular neighborhood of the planter. This may be called a new doctrine, in a Treatise on Planting. It is so, we believe, and we wish to have it understood that we address ourselves to the private interest, rather than to the public spirit of our readers; and we appeal to every one, who has had extensive dealings with mankind, for the propriety of our conduct.

"We are well aware that, situated as this country appears to us to be at present; planting ranks among the first of public virtues; nevertheless, we rather wish to hold out that lasting fame, which always falls to the share of the successful planter, and those pecuniary advantages, which must ever result from plantations, judiciously set about and attentively executed, as being motives of a more practical nature.

"We wish, in the first place, to do away a mistaken notion, that when once a piece of ground is set apart for a plantation, it becomes a dead weight upon the estate, or a blank in it, at least. Nothing can be less true; for plantations, entered upon with judgment, and carried on with spirit, accumulate in value, as money at interest upon interest. If an estate, after a plantation has been made upon it, is not worth more, by the trouble and expense of making it, than it was before, the undertaking was either ill judged, or badly executed. . . .

"Everything, however, depends upo management. It is not sticking in a thou and or ten thousand plants, as if for th sole purpose of saying, "I have don those things," without giving them a sec ond thought, that will ever bring in th profits of planting; yet, how many ge tlemen do we see squandering their mone laying their lands waste, and renderin themselves ridiculous, by such manag ment!"

From *Planting and Rural Ornament*, Anon. London, 1796.

Land Use

That "the economic prosperity of nation is highest when its resources a utilized in a manner that will yield th maximum satisfaction of human wants[1] is an economic fact which can be applie to all land and which means that eac acre must eventually be put to its highe use.

If one gets too familiar with the eno mous areas of waste land in the We he loses sight, at least definitely, that a most every section of the United State has its marginal and submarginal lan Starting from Corvallis, Oregon, this au tumn the author drove east to Philade phia, some 3,700 miles. An accurate su vey of the route traversed would indicat almost one-third of this distance as borde land, certainly not agricultural land.

The State of Pennsylvania, containin 28,692,480 acres, classifies 16,298,27 acres as agricultural, while published fig ures by forest agencies show some 15,000 000 acres as forest land. This indicates slight discrepancy, but also indicates tha

[1]Deibler, Principle of Economics.

the classification border is not definite. In traveling over the state, however, one is impressed with the millions of acres that apparently bear neither an agricultural or forest crop, in fact their only apparent use is to occupy the landscape.

In the very back yard of the teeming and populous cities of the great state of New York are similar areas. Every county in that state outside of the large cities has the problem of what to do with the abandoned farms. Since 1880 this has been going on at the rate of 40,000 to 50,000 acres per annum and since 1920 has increased to 250,000 acres per year. In other words New York State has some 4,000,000 to 5,000,000 acres of former farm land which is largely unproductive from any point of view.[2]

Is any forester so unwise as to say that "all land that is not agricultural should be placed in timber production?" If such a policy were followed many of the ills that now beset agriculture would be added to the wood fiber producer. In other words the less lumber produced up to a certain degree, for the next 50 years at least, the better the income of those that are producing. Naturally, to limit production to so small an acreage that prices of forest products would be excessive is not desirable. But neither is overproduction desirable.

In this connection a few quotations from Secretary Hyde's address of October 21, 1931, at Columbia University[3] are interesting:

"The fundamental problem in the agricultural situation in this country is that the production of the nation's agricultural plant, which is now too large for the needs, must be adjusted to demand for the products, and the essential feature in this is that the Nation must formulate and put into practice a sound national plan of land utilization. . . .

"The cure for overproduction is production balanced to market demand. . . .

"Our agricultural plant is larger than we need. . . .

"If we must err, it is safer to err on the side of conservatism and limit expansion strictly to our obvious requirements. . . .

"A proper national land policy will not solve immediately all problems of agriculture. . . .

"The individual farmer will have to show resourcefulness in meeting changes in world economic conditions. . . .

". . . limit our agricultural plant to such size as will supply the nation's need, without the ruinous blight of overproduction."

If one would substitute forest for agricultural plant and forester for farmer, would not the same prophecy hold true?

Professor Ferguson's article in the October number of the JOURNAL OF FORESTRY entitled "Can Idle Land Be Converted into Continuous Grazing Areas?" is a step in the right direction. If land is best adapted to grazing, should it not be used for livestock production and thus conform to the economic premise set out at the beginning of this article? If best suited to grazing, should the tax not be levied in proportion to the ability of that land to graze livestock? And to carry it further, if the highest use of any given land is running stock then to livestock production it should be alloted. And the same is true with recreation, mining, or any other land use. In fact the more one looks over the East the greater becomes the belief that recreation is and will continue to be one of the major land uses for forested and partially forested areas. And why not? If the people can secure

[2]N. C. Brown, in *N. Y. Times*, Oct. 18, 1931.

[3]The Official Record, Oct. 31, 1931.

more human satisfaction from an acre of beautifully colored trees regardless of how clean the bole or how much B & Btr. lumber it will produce, is this not its highest use? The people of the East can ship in their building material from the Pacific Coast or the southern states more easily than they can travel West to spend the week-end enjoying nature in those states. Nurserymen in Pennsylvania state the market is largely for trees for recreation planting rather than for timber production. And yet Pennsylvania is ideally located in many ways for the production of timber, with paved highways around every compartment and never more than ten miles to the top of any hill in the state.

With gas, oil and coal for fuel; with stone, clay, cement, lime and slate for building materials the demand for timber in Pennsylvania is reduced to a minimum. But even when the rabbit season opens, business and schools all but close down as everyone is out in the woods and brush land, filling his lungs with ozone, and maybe getting a rabbit. On pleasant Sundays through the year the woods and camping spots are crowded with people. What then is the use which the forest provides that fills the greatest use in the lives of the people of Pennsylvania? And what is true of Pennsylvania is more or less true of all the East, with its intense concentrations of people.

But what of the "twixt and between" lands of which Pennsylvania and New York have millions of acres, and other states in quantity? If the western forester does his work well where is the western stock raiser to summer graze his sheep and cattle? Anyone who has worked in a western national forest office knows that the almost daily complaint of the livestock owner is, "you foresters are keeping out fire and the reproduction is coming up so thick that my sheep and cattle are being starved." In other words if the western silviculturist does a good job the grazing privilege on the same land is going to decrease in value, or disappear entirely. Why should not a state like Pennsylvania or New York classify its land and say, "the highest use of this acre is to graze stock"? Probably they can raise fresh mutton chops and beefsteaks better thay they can raise 2 x 4's and shiplap. In much of this area it isn't "tree growth or nothing." In the Lake States it may be true that, "since the land is not needed for agriculture let it be used for forests[4]," but in many states there are numerous other uses that may come ahead of the wood-pile production. As foresters, let us seek the greatest use; for some at least have learned that forests are not a "cure-all" to control floods; to make it rain or to remedy our "land use" problems.

T. J. Starker,
Oregon State College.

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[4]G. S. Wehrwein, A Social and Economic Program for the Submarginal Areas of the Lake States. Jour. For., Vol. 29, 1931. P. 915.

REVIEWS

The Yale Demonstration and Research Forest near Keene, New Hampshire. By James W. Toumey. *Yale University: School of Forestry, Bull. No. 33. Pp. 106, plus 37 tables, 33 illus. and 2 maps and charts. 1932. $1.00.*

Thirty-third of the publications of the Yale School of Forestry this report is the final contribution of Professor Toumey to the series. There have been added since his death on May 6 a picture of the author and a well-deserved tribute to his competent, enthusiastic labors in developing the Keene Forest over a period of nearly two decades.

It is the orderly, thorough presentation of the facts concerning this forest that make the report of especial value to private landowners of tracts of similar character in this region.

This publication has wider significance, however, than its application to forests of southern New Hampshire. It will bear study by many in other parts of the country because it deals with common problems arising in the specific application of forestry. Theoretical assumptions are lacking; concisely stated facts abound.

In the words of the author "the Forest is conducted as a going forestry business with records of receipts and expenditures for the several stands of each compartment." The purpose of various undertakings has been "the building up of the forest capital and the improvement of the property as a forestry business under sustained yield." All this is taking place in a county of declining population, where consumption is growing less and where local small wood-using industries are declining and the quality of material from the forest, especially softwoods, grows poorer. The author says "The only way to raise the quality of local lumber is to attack the problem in the forest."

The first fourteen pages of the bulletin give an excellent description of the local and regional vegetation and an essential statement of environmental conditions affecting the forest. This is followed by a discussion, prepared by L. W. Rathbun, of utilization of the products of the forest and of stumpage and mill prices. Of particular interest to the forest economist is the behavior of prices during the period. One cannot avoid harking back to the local belief of twenty-five years ago that prices must continue to have an upward trend and remembering that on that basis companies acquired considerable holdings. They are now withdrawing from ownership of these. The actual trend of prices was upward during the first decade and then declining for reasons set forth in the report.

Forest records and accounts are important in the Keene Forest and attention of forest managers is called to the record sheet opposite page 26 as an interesting example of the form in use.

A brief statement covers protection features and the balance of the report deals with management considerations in the preparation of which H. H. Chapman, L. W. Rathbun and D. Pingree collaborated.

There is much well-condensed material in this part both in the text and in tabular form that deserves careful reading. Here again we find the author dealing

with practical matters and actual conditions the interpretation of which is carefully set forth. The silviculturist will be specially interested in the treatment which has been given to the various forest types and one interested particularly in management problems will find much in the exposition of inventories, growth and financial considerations.

The appendix is bulky with tables dealing with volume, yield and financial computations. It is followed by the plates which are excellent in visualizing managed stands in various stages of treatment and help greatly in appreciation of the descriptive statements in the report.

Viewed as a whole this bulletin is the sort of publication of which we need many to present, as excellently as this one does, real cases of forestry practice. Can the private owner practice forestry? Read this bulletin and draw your conclusions.

SAMUEL N. SPRING,
N. Y. State College of Forestry.

European Larch in the Northeastern United States: A Study of Existing Plantations. By Stuart S. Hunt. *Harvard Forest Bulletin No. 16. Pp. 45, 6 tables, 8 figures. Harvard University Press, Cambridge, Mass. 1932. $.50.*

This bulletin maintains the high standard of other publications coming from the Harvard Forest School. The bulletin is based principally upon a study of European larch plantations in New York, Massachusetts, Connecticut, and Vermont, but is supplemented in some particulars by information from European sources.

Insofar as experience with European larch in the northeastern states gives the clue, this bulletin answers the questions that ordinarily arise in respect to any species of tree when its culture is under consideration. There are chapters upo the distribution of European larch, it growth and yield, silvical characteristic susceptibility to injury, culture and man agement, and properties and uses of th wood. There are several illustrations an six instructive tables.

One of the extremely important, if no the most important, points brought out b the bulletin is the fact that in Europ there are three varieties of this species the Tyrolean, the Silesian, and the Scotch The Tyrolean variety is much inferior t the other two in a number of respects The author rightly stresses, accordingly the need for extreme care in selecting see for use in this country. It should be ob tained from Scotland or Silesia.

As is perhaps realized in a general way European larch is extremely susceptibl to the influence of light. It should neve be used for underplanting. The bulleti includes a table which in a rought wa indicates for the better sites the desirabl number of trees per acre at various ages This table can be used as a guide, bu by no means an infallible one, in th making of thinnings.

The study indicated strongly that Eu ropean larch is rather exacting in its soi requirements. For its best development, i should be planted on well drained loams fine sandy loams, or loamy fine sands Nothing much can be expected of it o sandy and gravelly soils which dry ou excessively during the hot summer months Neither should it be planted in poorl drained wet places, such as those wher our native larch is often found growing As is also true in Europe, the evidenc obtained in this study is that this specie does not reproduce itself readily. Thi fact is certainly nothing in its favor.

For field planting the author recom mends the use of sturdy stock not ove three years old. He feels that densel grown two-year seedlings are too smal but that if not densely grown, such stoc

is all right for that purpose. Unfortunately, he does not give us a clue as to just what he means by densely grown. He makes the good point, however, that of 21 plantings in New York of this species classed as failures, 75 per cent were due to the use of too small stocks. October is apparently the best month for field plantings, although the author is not yet ready to abandon altogether the idea of spring planting. It is presumed that he would not advocate October planting if the soil were extremely dry, as is often the case in that month.

On the whole the discussion of pure and mixed plantations is good. In general, the planting of larch in mixture with other conifers singly here and there, or in small groups not over 40 feet across, is recommended. The statement is made that larch will outgrow all of the other conifers commonly planted except Norway spruce. Why Norway spruce in particular? This looks like a slip. Norway spruce surely does not grow more rapidly than white pine or Scotch pine. Growth and yield tables indicate that the European larch does grow rapidly in height and diameter up to 50 years of age but is then likely to fall behind white pine. So far as volume production per acre is concerned, it falls far behind white pine. The yield in 60 years on site quality I, is at the rate of about one cord of unpeeled wood per year.

The discussion of properties and uses of the wood leaves a little something to be desired. The reason, without doubt, is because we have had so little experience with the species in this country. While European experience as quoted reveals that the larch is perferred for railroad ties, mine props, etc., there is nothing to indicate that it is a vastly superior wood for those purposes. One wonders how it would compare with chestnut, white oak, and black locust. An opinion is rather prevalent in this country that European larch should be grown for fence posts. That means trees from six to nine inches in diameter. On good sites trees reach that size at an age of from 20 to 35 years. Would such trees be much good for fence posts? Wouldn't they be nearly all sapwood and practically worthless for fence posts unless creosoted? If they have to be creosoted, why are they any better than red maple, for instance, a tree which occurs naturally in great quantities in the northeastern states? A more general discussion of this question would doubtless have been welcomed by most readers of the bulletin.

Table No. 6, Summary of Data, etc., will be useful to anyone wishing to know where European larch plantations are located and to afford specific pictures of these plantations.

All in all, the bulletin is good. It is an honest analysis of the species. It does not play up the larch as a world beater. As a matter of fact, after reading it, one is likely to conclude that the tree is not one to become overly excited about but that it may fit here and there into the forestry picture in the northeastern United States. Perhaps the full possibilities of larch as a nurse tree for such species as white pine or black locust, both of which seem to be less susceptible to serious insect attack when grown in mixture with other trees, have not been fully developed.

C. R. Tillotson,
U. S. Forest Service.

Die geschichtliche Methode in der Forstwirtschaft. (The Historical Method in Forestry.) By H. Martin. *Julius Springer, Berlin. Pp. viii. + 290. 1932.*

Under the somewhat high sounding and misleading title that appears above, Dr. Martin has written a very interesting and sensible book on silviculture and manage-

ment of the German forests. The title could with more accuracy be called "Forestry in the light of experience," for that is precisely what it is. The author, undertaking the book in his eightieth year, covers the evolution of forestry practices in Germany since 1867, when he entered the profession, in a manner that would be difficult indeed for a younger man. The period previous to 1867 is covered in a less distinctive manner, the viewpoints and work of the "fathers of forestry"—Hartig, Cotta, Pfeil and others having long since assumed a fixed form due to the perspective of time. Fernow's *History of Forestry* presents much the same picture of that age as does Martin. His projections of history forward into the future are cautious and conservative.

The book is divided into two sections, the first on silviculture, the second on forest regulation.

The silvicultural section is divided into four parts covering respectively silviculture of individual species (practically limited to beech, oak, pine and spruce), silvicultural systems, methods of regeneration, and thinnings. This arrangement of material involves a good deal of virtual repetition especially in the discussion of mixed stands.

In such a work as this the viewpoint of the writer is the soul of the book. Dr. Martin is a moderate, neither excessively radical nor conservative, leaning strongly to Pfeil who insisted upon a flexible silviculture based on site, climate and markets. The evil effects of continued cropping of pure, even-aged stands is dwelt upon and the remedy is held to be growing mixed stands, especially with beech as a component. The rôle of beech in soil building is repeatedly insisted upon. He does not swing nearly so far toward a "natural" form of silviculture as many modern silviculturists, especially of the "continuous forest" school, and would still hold generally to clean cutting and the growing of even-aged stands. The evils of this system he holds are not inherent, but are due to misapplication. The clear-cut areas should be small, of correct shape and orientation, and successive cutting areas must proceed in proper directions if satisfactory reproduction is to be attained. With proper precautions of this kind mixed forests can be naturally regenerated, at least, much more widely than at present.

The field of thinnings offers perhaps the greatest chances for improved practice today. Dr. Martin ventures to prophesy that more attention is going to be paid to the trees in the dominant position and less to the removal of trees in the lower crown classes in the future development in thinning practice. The yield per acre may not be capable of much increase but the growing of large technically perfect specimens certainly can go much farther than it does at present.

The second section on forest regulation has been less carefully examined by this reviewer. In this section, Dr. Martin has six main parts which take up the division of the forest working units, mapping, forest capital, setting up cutting sequences, determination of rotations, determination of annual felling budgets. In all these fields the author maintains an eminently sensible attitude neither leaning wholly to the rigid mathematical viewpoint whose shortcomings have been so patently exposed, but yet, on the other hand, refusing to be stampeded into throwing most all of formal forest regulation overboard in an attempt to make natural ecological conditions the whole sum and substance of good forestry. Here too he recognizes the need of flexibility and a minimum of rigid rules and policies.

To the American reader the book is interesting, and in a broad way, the historical developments in Germany have certain lessons for us, warning against the dangers of soil deterioration on great cut-over

areas, of the wisdom of mixed stands, but of the general inadvisability of pushing naturalness so far as to almost revert to wild forests. Perhaps his greatest contribution to American viewpoint is his reiteration of Pfeil's old insistence upon a free flexible silviculture applied with good judgment rather than by the application of rigid rules and policies both in silviculture and management.

We can also join him in his firm faith in a statement of Goethe "In der Beschränkung zeigt sich erst der Meister"—which may be rather clumsily rendered—"Under limitations the master is revealed." Both Germany and America have their quota of limitations. The crop of master foresters should be large.

F. S. Baker,
University of California.

Exotic Forest Trees in the British Empire. By R. S. Troup. *Pp. 259, Maps 4. Oxford University Press, Oxford. 1932. $6.50.*

A surprisingly large number of tree species have been introduced from their native homes to distant lands. This is particularly true in the far-flung British Empire. In some cases exotics were introduced for novelty or out of curiosity but oftentimes it was done with definite economic aims. In this book are included "only those species which have been tried for plantation purposes, whether for the supply of timber and other produce or for any other reason." However, some trees now grown only for ornament have been included where they give promise of value for afforestation purposes. The arrangement is alphabetical by botanical names. Each species is treated very briefly, first as to its development in its native habitat and the soil, temperature and precipitation of the region. Then follow even briefer notes on the results of planting the species in various parts of the Empire. With 220 pages of a 259-page book devoted to these species reports it was hardly possible to expand on the results of plantations outside the natural ranges, however, where a failure is reported the reader is left in doubt as to the reason and he may conclude that the species is not adapted. In the introduction the author makes clear the limitations of the work. The book will be of value to many outside the circle of foresters interested solely in possible introductions. A bibliography of 152 numbers is referred to in terminal notes after many of the species reports.

Emanuel Fritz,
University of California.

Elements of Forest Mensuration. By Herman H. Chapman and Dwight B. Demeritt. *J. B. Lyon Company, Albany, N. Y. Pp. 452, figs. 92. 1932. $3.50.*

Professor Chapman's *Forest Mensuration* appeared in 1921 as a successor to Graves' book of the same title, and for ten years it continued to be the standard text on the subject in American forest literature and probably among foresters of most other English-speaking countries as well. Dean Graves' well-known work had played a similar outstanding rôle from 1906 until its revision was undertaken fifteen years later.

Remarkable advances have been made in mensuration since 1921, to a certain extent in general practice but more particularly in the development of research, and in increased interest in the subject on the part of foresters generally, greater attention being given to new methods, refinements of technique and critical analysis of field data.

The appearance of this book by Chapman and Demeritt is therefore of unusual significance, to which further interest is given by the arrangement of the subject matter. It is stated that the conventional treatment of previous books has been found unsatisfactory for class room instruction and that revolutionary results have been secured by adopting the economic approach to the subject, which is described as based on "the relations which determine the value of the products and of the standing timber, and for this reason govern the character, intensiveness, and cost of all operations in 'Forest Mensuration'."

In the words of the preface:

"The new method as followed in this text has three conspicuous features. First, it begins with the product and its measurement, then follows this product into the log or bolt, totals the contents of these pieces to obtain tree volume, shows how this volume can be measured in standing trees and finally discusses the problems of measuring the product in a stand of timber and on large areas of land.

"In the second place, it does not attempt to cover completely any step in this process, such for instance as construction of volume tables, in connection with the *first* chain of events, based on the cord or cubic foot, but brings into this first discussion only those elements needed for this problem. When the cubic foot has been covered, the board foot is taken up and the same sequence observed. The construction of volume tables and the requirements of timber estimating are then enlarged upon, since the necessity of these improvements in technique is apparent at this point. . . .

"The same revolutionary procedure has been applied to the study of increment. Growth *per acre* is the result sought by such studies and this, which is the final product of the measurement, is in this text given first consideration. The *application* of yield tables for even-aged stan is followed by their construction. . . ."

The main body of the manuscript w written by Professor Chapman in 19 the junior author contributing a n chapter on the construction of alinem charts for standard volume tables, a coöperating in the preparation of a n chapter on statistical methods. As appendix, there is given a very thorou outline, with numerous references to main text, of the procedure to be f lowed in a forest survey or stocktaki

The new book is intended and describ as a text for beginners and an introd tion to the subject, definitely *not* a co plete treatise. In the reviewer's opini Chapman and Demeritt have met the quirements of such a book in a m effective way. Their work is thoroug scholarly, and progressive, free from bi and particularly well adapted to cla room work. The arrangement of the co tents which has been selected causes discussion of a definite subject, such tree form, for instance, to be broken into widely separated subdivisions, a while this may be of advantage for tea ing purposes, it makes reference diffic for anyone who is not going through entire book.

This new treatment of the subject— the "economic approach"—will certai give rise to active comment and if book is not studied carefully the comm probably will be unfavorable. But fo teacher who has to present the subject a class of beginners, the method has mu to commend it. Final judgment must withheld until the new system has ceived a thorough trial at the hands other experienced teachers. It should noted, however, that the book is perfec adaptable to use as a text for a treatm of the subject in the conventional mann

Another recent book in mensuration also adopted the method of insert chapters dealing with statistical meth

d alinement charts, as a means of keep-g abreast of recent literature. The re-ewer is not convinced that a textbook in rest mensuration is the proper place r a discussion of statistical methods tended for those unfamiliar with the bject. If statistical science should be plied to the analysis of mensurational ta in forestry, and no thoughtful ob-rver will deny this, then its application ould be made to the treatment of vol-ne tables or cruising or other details a matter of course, and forestry stu-nts should be taught statistics as they ould be taught algebra or chemistry,—om recognized texts which give a thor-gh and comprehensive treatment of their bjects. Such a treatment of statistics is possible in a brief chapter inserted into book on forest mensuration and is no ore desirable there than would be a hapter dealing with solid geometry as rerequisite to the study of cubic-foot olume tables. It may be said here, that ere is no text yet available which gives ch a satisfactory exposition of statistical ethods as the thorough and scholarly ttle volume by Yule, on which most sub-quent works have been based.

Practically no reference is made to sta-stical methods in *Elements of Forest Iensuration* apart from the inserted chap-r, and one feels that it might have been ore satisfactory to refer students to a andard statistical text for a study of rinciples, and then to give one or two lear, definite examples of applying these rinciples to such practical problems as e determination of cruise per cent, the ejection of yield plots, or the finding f how many trees are necessary for a olume table. This system of illustrating principle by means of examples is emonstrated admirably in Champion's ew *Silvicultural Research Manual.*

The treatment of the less important de-ice of alinement charts is very thorough, ith numerous examples of their applica-on to tables of both volume and yield.

Better balance would have been achieved in the new book if equal space had been given to the application of biological science as well as mathematics. It is well that science should be applied to mensuration, but one should not select only one phase of science. The results of *growth,* both of forests and trees, may be analyzed by means of mathematics, but that same growth is produced by biological processes, which should be understood by the forester if he is to be familiar with his stands. As one outstanding American forester has said, "Apart from Chapman, the mensurationists seem to know little about the woods and a lot about mathematics." This is, alas, true.

The phases of forest mensuration on which we are most ill-informed in North America are those dealing with diameter growth, recovery of the underwood, mortality, the effect of thinnings on growth, rate-of-closure, and the whole broad field of mensurational technique in plantations. These will all be important questions in the near future, and their answers can be found only by the recognition of mensuration as a biological *as well as* a mathematical subject.

The new book covers very satisfactorily the extensive literature of the past ten years. Dwight's important work on diameter growth receives adequate attention for the first time. New methods in volume tables and yield tables are presented and the usefulness of growth per cent is discussed. The application of yield tables is mentioned rather briefly and it is unfortunate that the recent manuscripts of Barnes and Reineke on average diameter did not appear a few months earlier, as the inclusion of their methods in the text would have greatly strengthened this chapter.

No reference is made to the technique employed in the national Scandinavian forest surveys during the past ten years. Many new features have been developed, particularly in Sweden, which are applica-

ble to American conditions. The very inexpensive Swedish steel calipers are better in every way than the conventional awkward wooden instrument of North America. If they were better known they would be generally adopted on this side of the Atlantic for both research and forest school work.

Professor Chapman's style is not always easy to understand. It is forceful and thorough, but frequently the meaning is not clear. Such a style may not make for ready comprehension, but it does cause careful reading, and thoughtful consideration of a paragraph is about the only method by which its meaning can be definitely and permanently assimilated.

The book is well printed and bound and Professor Chapman's new publishers are to be complimented on their product. More careful proof reading would have eliminated a few typographical errors, and the well-executed plates are deserving of better original drawings. There is no excuse for poor lettering or line-work in drawings which are to be reproduced in a textbook which is to be a national standard.

The senior author of this book is universally esteemed as a scholar, an authority and a prodigious worker. His new text more than meets the high standards set by his previous well-known works, and it can be recommended without qualification as the best book on the subject which is available. Professor Demeritt has been honored in being selected as co-author, and has justified Professor Chapman's choice by giving an excellent contribution to the book as joint author.

The new text has been dedicated to James William Toumey, and *Forest Mensuration* was inscribed to Bernhard Edouard Fernow,—two good books which fittingly commemorate two wise leaders of American forest education.

P. M. Barr,
Forester, B. C. Forest Branch,
Victoria, B. C.

The Possible Utilization of Disease a Factor in Bracken Control. B Mary J. F. Gregor. *The Scotti Forestry Journal. Vol. 46: No. March, 1932. Pp. 52-59.*

The common bracken fern (*Pteris aqu lina*) is a pest in many parts of the worl In Scotland the bracken fern is encroac ing upon hill pastures and other arabl land to an alarming extent, and cons tutes a serious obstacle to afforestatio in many districts.

The Department of Agriculture f Scotland has been investigating the que tion of bracken and its control for sever years. In connection with a control pr gram, the possibility of utilizing disea is suggested.

The bracken fern in Scotland is susce tible to two fungous diseases, which a briefly described.

One of these diseases, and probably th more important of the two, is of unknow origin, but it is believed to be caused b the asexual stage of *Mycosphaerella*, th species of which has not yet been dete mined.

The other disease of bracken is appa ently caused by a species of *Corticiu* Infection experiments show that this fu gus may act as a vigorous parasite und abnormally moist conditions. If add tional study confirms the belief that a normally moist conditions are necessa for this fungus to vigorously attack th bracken, its use as a means of controllin the bracken will be considerably lessene

The bracken fern is widely distribut in the United States and in some regior the Pacific Northwest for example, it ma under certain conditions, not only reta reproduction, but also increase the fi hazard. At this time, however, it seen doubtful if the bracken fern is as seriou an obstacle to reforestation in the Unite States as it appears to be in afforestatio in Scotland. The importance of its co trol in the United States, therefore, do not appear to be acute.

Nevertheless it would seem worth while for American forest pathologists to give a little more attention to the possibility of controlling the growth of certain indigenous shrubs through disease. On certain areas in the Lake States the hazel and the alder are serious obstacles to successful forest planting. The introduction of a disease of hazel which would reduce its rate of growth to one-fourth of its normal growth would greatly enhance the possibility of successfully planting brushy areas.

However, the biological control of any plant through the introduction of a fungous disease is not without danger. Only after the most thorough study of all the factors involved should such a program be considered. It must be definitely known that the disease will not attack any economic plant in the region, and it must also be known what will happen when the obnoxious plant is removed from the area. It is possible that an equally obnoxious, or even more obnoxious plant, will take its place.

Introduced tree diseases have already caused millions of dollars' damage to American forests. The control of the chestnut blight and the white pine blister rust are already taxing to the limit our pocketbooks and our ingenuity. Of these we need no more.

HENRY SCHMITZ,
University of Minnesota.

Why the Mayan Cities of the Petén District, Guatemala, Were Abandoned. By C. Wythe Cooke, U. S. Geological Survey. *Jour. Washington Academy of Sciences, Vol. 21, No. 13. July 19, 1931.*

"Two thousand years ago what is now Petén District of Guatemala was the seat of a flourishing Mayan empire. Its massive temples and palaces still mark the sites of large cities which endured many generations but were finally abandoned. Today, that once populous region is, for the most part, totally uninhabited. The great cornfields which fed its people lie hidden in a dense forest. The region comprises uplands and bayous, or lowlands. The bayous are flat plains with little relief, underlain by tough carbonaceous clay, are inundated in the rainy season and are waterless in the dry season, are covered with tangled vegetation, making travel difficult at all times. The bayous were formerly lakes, which have silted up."

The author concludes that the transition from lakes to bayous or marsh land may have occurred during the time of the Mayan empire when much of the uplands must have been under cultivation to supply food to a large population. Rates of erosion must have been enormously accelerated when the forest was cut and the cultivated soil was exposed to the full force of torrential rains. Neither water supply nor ways of transportation exist at present. Prior to silting the numerous perennial lakes would have furnished both water and means of transportation. Thus some of the factors which may have caused the decline of the Mayan empire and depopulation of the Petén are listed by the author as, "(1) erosion of the soil and consequent scarcity of arable land, (2) silting of the lakes and the destruction of water transportation, (3) diminution of the water supply during dry seasons, (4) increase in the number of mosquitos, and (5) introduction or increase of malaria."

If the author's conclusions are correct the Petén furnishes a most dramatic example of suicidal agriculture—a process, which is also in operation in varying degrees in many sections of our own land.

W. C. LOWDERMILK,
California Forest Experiment Station.

Baumkrone und Schaftzuwache. (Tree Crown and Stem Growth.) By W. Busse. *Forstwiss. Centralbl. 52: 310-318. 1930.*

The author begins with the assumption that, "Each tree must have adequate growing space at its disposal in order to succeed advantageously." In an attempt to confirm this statement graphs are presented showing the relation between crown length, crown (greatest) diameter, and crown area (length x diameter) and the growth increment as determined by periodic measurements of the stands investigated. The species studied were oak, beech, pine, and spruce. Admitting that the method of crown measurement may be faulty and that the results fail to show a good correlation between stem growth and crown size, nevertheless the lack of correlation is attributed largely to prominent individual tree characteristics.

Using both the green weight of twigs and needles and the oven-dry weight of the needles of nine spruce trees representing different crown classes, the author obtains a much better correlation between growth increment and crown mass. The curve showing the relation between the weight of green needles and the stem growth is so similar to the one showing the relation between dry needle weight and stem growth that he says "From these curves it is evident that it was not necessary to go to the trouble of establishing the dry weight." Variations found in the correlation of needle weight and stem growth, likewise, are ascribed to individual tree characters. Reference is made, also, to an article by Burger, Mitteilungen der Schweizerischen Centralanstalt, Band XV, Heft 2, which gives somewhat similar results. In addition, however, Burger offers the suggestion that in large thick crowns all of the needles may not work actively.

Benson H. Paul,
Forest Products Laboratory,
Madison, Wis.

A Study of Several Coniferous Und[d] plantings in the Upper Huds[o] Highlands. By H. H. Tryon. *Bu[l] No. 3 of the Black Rock Fore[st] Cornwall-on-the-Hudson, New Yo[rk]. Pp. 27, 12 plates, 1 text figure. 19[3]*

This is the third contribution from t[he] Black Rock Forest to the forest literatu[re] pertaining to forest practises in the U[p]per Hudson Highlands of New York.

In the text and through the aid of photographic reproductions, Mr. Try[on] shows the inadvisability of conifero[us] plantings under a hardwood overstory u[n]less cultural treatments can be applied [at] frequent intervals. The text figure grap[h]ically portrays the slow growth and d[e]velopment of conifers planted in har[d]wood stands.

Plate III of a 50-year old group [of] Norway spruce shows more than the a[u]thor calls attention to—namely, that No[r]way spruce reaches its optimum develo[p]ment under 50 years of age and after th[is] time the trees rapidly deteriorate. T[he] crowns of the spruce trees in the pictu[re] show this condition very plainly.

G. H. Lentz,
Southern Forest Experiment Station.

Vergleichende Untersuchungen üb[er] des Dickenwachstum und d[as] Spezifische Gewicht der Lärch[e] des Westungarischen Hügelland[es] (Comparative Investigations Co[n]cerning the Diameter Growth an[d] Specific Gravity of Larch fro[m] the West Hungarian Highlands.) By F. Worschitz. *Centralbl. Ge[s]. Forstw. Vol. 56. Pp. 170-183. 193*

A comparison is made of the rate [of] growth, the percentage of summerwoo[d] and the specific gravity of the wood [of] larch (*L. decidua*) planted in the hi[gh]lands of western Hungary, where lar[ch] is not native, with larch from the alpi[ne] foot hill and high mountain region[s]

The elevations above the sea level for the locations studied are: West Hungarian highlands (Kiskomarom) 80 meters; alpine foot hills (Agfalva) 400 m.; high mountain Alps (Samoden, Switzerland) 1.770 m.

The growth measurements were taken on disks cut at intervals of about 1 meter throughout the length of the tree stem. The cross-sectional area of the growth by 5-year periods was planimetered on each of the disks and the summerwood portion of the annual rings measured. Pieces of wood for specific gravity determination were taken along the average diameter on each of the disks.

It was found that the larch from the west Hungarian highlands grew rapidly at first but the growth rate quickly diminished and reached a minimum at about 50 years of age, while in the sub-alpine larch growth was well sustained until the 90th year and in the high mountain larch continued with little decrease for a still longer period. However, the slower growth of the high mountain larch required 80 years to equal the diameter attained in 45 years by the west Hungarian larch.

The specific gravity of the wood of the west Hungarian larch was the lowest, that of the high mountain larch the highest, and that of the sub-alpine larch intermediate. The wood of the high mountain larch was fairly uniform throughout with respect to rate of growth and specific gravity. In the other two regions the wood near the center of the trees contained wide annual rings and was much lighter in weight than wood of slower growth toward the periphery of the trees. The investigations were said to confirm the empirical knowledge with respect to the better technical usefulness of the high mountain larch.

The percentages of summerwood given by the author for material from the three regions do not correspond in the usual manner with the specific gravity determinations. The measurements show the wood of lighter weight to contain a higher percentage of summerwood. This very likely is due to the difficulty of making accurate measurements of summerwood. There is also the possibility that the summerwood of the larch at the lower elevations was less dense than the summerwood of the larch in the high mountains.

The author recommends a rotation age of 50-60 years for larch in the western Hungarian hill lands, a rotation of 80-100 years in the Alpine foot hills, and a still longer rotation period for larch growing in the high mountains

The methods of making mathematical calculations of growth, the summerwood measurements, and the specific gravity determinations are described in detail. Eleven figures are presented showing growth rate, percentage of summerwood, and specific gravity. Three tables of results and a diagram of the tree form in each of the localities are included.

BENSON H. PAUL,
Forest Products Laboratory,
Madison, Wis.

The Significance of the Natural Scientific Foundations of the Thinning Theory. (Ueber die Bedeutung der naturwissenschaftlichen Grundlagen der Durchforstungslehre.) By M. Kienitz. *Zeitschrift Forst.-und Jagdwesen, No. 5, Vol. 63, May 1931. Pp. 32, 3 figures.*

It is a rather remarkable and also regrettable fact that in the development of those cultural forestry practices which are classed under the category of thinnings the profession has given little or no thought to the underlying physiological principles. Too much attention is focused on the ultimate result, and too little upon the factors which control the character of the result. These factors are based upon consid-

erations affecting the individual members of the forest stand, and specifically, upon considerations involving a proper understanding of the functional capacities of and physiological differences between light and shade needles and leaves, which have a direct bearing upon the subsequent development of the residual individuals in a thinned stand.

Observations by the author, some sixty years ago, indicated that when suppressed trees were released by thinning, the suddenly exposed shade needles, and those trees whose crowns were composed entirely of shade needles, died as early as the first summer. Considered from this standpoint, the well known Borggreve selection system of thinning, which undertakes, at about the age of 60 years, to cut and remove the dominant trees and to release the intermediate and suppressed trees in the expectation that they may be stimulated to faster growth, is based on the false premise that all the leaves of a tree possess a similar physiological status. The author's experiments have shown that various needles of spruce, in order to exercise their full assimilatory activity, must be exposed to approximately the same degree of light in which they originated and developed. Also light needles, when crowded into the shade, cannot assimilate to the full extent in which they may function if left in full light, and much less can shade needles assume the functional capacities of light needles when light conditions are improved, or be expected to transform themselves into light needles. The author's early experiences were later substantiated by Arnold Engler who arrived at essentially the same conclusions in his studies with beech.

The question arises, why investigations along this line have not been continued? The answer is simple: Because this line of investigations must be carried on, not as a side-line by an administrative forester, but by one who can give all of his time and energy to the problem. (Where have we heard this before?) During the last half of the nineteenth century appreciable progress was made in developing the practice of thinning in west Prussia. The theory of thinning, however, at no time advanced beyond the elementary stage, being confined primarily to that known as dry thinning (Trocknishieb). When the author was placed in charge of the Forest of Chorin in 1888, his principle concern was in connection with revising the standard thinning practice. He recognized the deficiencies of the mechanical "Trocknishieb" and the evil consequences attending the vogue-like selection thinning. He introduced a system which combined the former with a modified thinning of the principal stand to remove the hopelessly sick stems. One of his chief tasks in accomplishing this was to win over his assistants to this viewpoint. This was necessary in order to obtain success with the new thinning practice, which was a step ahead of the former purely mechanical practice.

In visualizing a thinning what kind of a picture must a forester have in mind? First, he must know what possibilities for development are possessed by the stand. He must also understand the nature of its physical structure. The ultimate stand should consist of healthy members, which are adapted to the site. Their forms should be such as to yield the highest technical possibility of utilization. The forest community must be capable of utilizing to the fullest possible advantage the priceless physical factors which control growth, namely, light moisture, soil, and atmosphere. To accomplish this, the development of a crown cover with the largest possible number of light needles in the outer layer of the canopy where assimilation is most economically accomplished is demanded. Small openings in the canopy must be filled up by the crowns of trees in the understory.

The question of whether thinning increases or decreases the total volume increment of a stand has been discussed pro and con in recent years. In the old days, the answer seemed simple enough, but with the introduction of the practice of attacking the principal stem classes, the situation became more complicated. When the primary crown cover is opened, an increase in total increment is possible only when the increase in increment of the released stems exceeds that lost in the felled stems. This condition can only occur when the openings left in the canopy are once again filled with light needles. In such a thinning, however, it must be remembered that the released crowns contain more shade than light needles, also that the released half shade and shade needles cannot be transformed into light needles. Under favorable conditions they may continue to live and in the course of time develop axillary buds which eventually produce light needles. According to Engler this occurs in beech, but Kienitz states that in spruce the released shade needles and shoots succumb. These phenomena are too little observed, however, by the average forester.

In order to attain the desired end, the thinning must necessarily be conservative. Frequent returns, therefore, are inevitable. A return every three years is more or less necessary to procure the desired results. In this connection, the old precept to thin early, frequently, and moderately retains its significance. However, it is not necessarily to be assumed that older stands are not amenable to such treatment.

The filling of openings occasioned by cuttings of moderate intensity is often accomplished by the subsidence of twig tips and side branches bearing light buds and new shoots of neighboring trees. This process proceeds rather slowly, however, and this fact lends emphasis to the possibility of simplifying the process by the cultural development of the under stand. In the past, this situation has, at times, given rise to over-development of the understory, and to the replacement of a desirable coniferous crop by a fast growing and unduly favored, but less desirable, hardwood stand. The thinning process, therefore, should also be extended to the understory. In order to maintain the density of the body of the stand, a living understory is a more effective agent than the side branches of the dominant stems.

Whether artificial pruning, in combination with thinning, will be practicable in future forest management depends upon conjectural conditions, such as the future price of forest products. More pruning experimentation is desirable in order to determine the important relationship between crown length and clear length of stem.

The thinning problem is not entirely solved when the difference between the varying capacities between light and shade needles is recognized. There still remains the unknown equation involved in determining the degree of this difference between species. The answer, no doubt, must be sought in the cells of the tissue constituting the upper surface of the crown cover or more probably in the chlorophyll itself. These relationships must be determined by pure physiological study.

In the final analysis the most effective development is procured where the entire crown surface consists of light needles. Considering the fact that diffuse light is more useful for assimilation than direct sunlight, it also holds that an uneven cover, with high points and deep depressions, satisfies conditions better than does a flat cover. The development of such a cover also falls within the scope of thinning objectives.

J. Roeser, Jr.,
Rocky Mountain Forest Experiment Station.

Consumul de Lemn al Bucurestilor (The Wood Consumption of the City of Bucharest). By Gh. I. Ionescu. *Revista Padurilor, Vol. 43, No. 9, Sept., 1931. Pp. 771-782.*

The author compares the economic conditions of the rural population of Roumania (80 per cent of the country's total) with those at the capital city and finds that the per capita fuel consumption is larger and the lumber consumption smaller in the city as compared to the rural districts. The annual consumption for Roumania is:

Product	Consumption per capita. Cubic feet	Consumption. Total for population of 18 million Million cubic feet
Lumber	10.5	189
Fuel wood	32	576
Total	42.5	765

There are 28 mills and woodworking establishments and 436 sales yards for lumber and fuel wood in Bucharest.

At the close of the article the author treats of the influence of the wood consumption on the forests surrounding the city of Bucharest. From two maps, one dated 1791, and the other 1856, the reader is shown the change in the distribution of the forested land in the two districts known as Vlasia and Mostistea in the vicinity of Bucharest.

R. Stahelin,
University of California.

Recent Forestry Progress in China. By D. Y. Lin, Director, Central Forestry Bureau. *China Weekly Review, December, 1931, Shanghai.*

Despite political, social, and communistic disturbances, forestry has been making steady progress in China. Fifteen years ago terms for afforestation (tsao-lin) and forestry (sen-lin) were scarcely heard but today these have become household words as the result of public recognition of the need and work of foresters. Since the establishment of the national government at Nanking administration of forestry work has been placed in the Forestry and Reclamation Service, which is charged with reclaiming and colonizing waste lands in China proper and in border provinces, with general forestry administration of the country, with supervision of afforestation areas, protection and management of national forests, establishment of natural parks, protection forests, etc.

The National Forestry Conference in the fall of 1929 proved to be a landmark in the development of forest policy. The recommendations of this conference now serves as a guide for forestry work in various provinces.

Afforestation by the Central Government is being conducted by the Central Forestation Bureau, which is creating a model forest in the vicinity of Nanking. This is the beginning of a policy to establish throughout China national forest reserves. During the first two years of the Bureau's existence, nearly seven million trees were planted in the vicinity of Nanking. Government nurseries are being established to supply tree plants free of charge. Forestry work in the provinces has been actively pursued for varying periods of time. Some provinces, such as Kiangsu, Shansi, and Anwhei have strong forestry departments. The combined provincial budgets amount to over $850,000 (silver). Private and corporation activities constitute the largest forestry enterprise of the nation. The continuous supply of important timber supplies of the Foochow pole (*Cunninghamia lanceolata*) trade throughout the country is due entirely to private enterprise in forestry. Fuel supplies in many sections is dependent on private forestry. The most conspicuous piece of forestry work done by

corporate effort is the Kiangsu educational forestry enterprise at Lao Shan, which has been going on for 15 years. More than 54 million trees have been planted and a large grass area of hills and mountains has been converted into a beautiful forest. Private forestry in other provinces has made remarkable progress in spite of the fact that the government has done little to encourage it.

The public interest in forestry may be ascribed to the work of the Chinese Forestry Association, to the teachings of Dr. Sun Yat Sen in the San Min Chu I. (Three Principles of the People), and to the establishment of Forest Memorial Week. The forestry association was founded in 1917 and continues to advance forestry. Dr. Sun Yat Sen's teachings emphasized the importance of forests for the public welfare, and included it as an enterprise in his "Program of Industrial Reconstruction." The Memorial Forest Week, is more than an "Arbor Day" and serves to commemorate the interest of the founder of the Chinese Republic in forestry as well as to advance the cause of encouraging forestry.

Forest education began as early as 1911, as courses in high schools. The first forestry school of college grade was established by Joseph Baillie at the University of Nanking, with Purple Mountain, now a national park, as a field laboratory. Growth in forestry education was rapid until in 1923 there were 10 colleges and universities offering courses, and fully 74 provincial secondary schools included forestry courses. Lack of text-books and adequately prepared teachers brought about a discontinuance of many of these schools until today there remain but four colleges and universities offering forestry work toward degrees. Of these University of Nanking has the largest enrollment and alumni.

Public interest in forestry has been aroused and it must now be supported by practical work. The pioneer stage of agitation has been passed and the permanent phase of practice by the profession of foresters is now being entered.

W. C. LOWDERMILK,
California Forest Experiment Station.

On Methods of Erosion and Flood Protection in Transcaucasia. (In Russian.) By I. I. Roschin. *Bull. No. 7, The Transcaucasian Experimental Research Institute of Water Economy, Tiflis, USSR. 1931.*

Numerous investigations of American and Japanese foresters as well as the Russian studies of Professor Vysotsky and Professor Curdiani have shown clearly the importance of vegetative litter cover in the distribution of rain into superficial run-off and percolation. It seems that Raphael Zon in America and some European investigators have limited the role of ground litter cover only to its absorptive capacity. But recently and American forester, W. C. Lowdermilk, has definitely proved that ground litter cover is far more important than it was supposed. The author gives a detailed description of Lowdermilk's experiments. Professor Dubakh has found in southern Russia that run-off coefficients were as follows:

From a pasture	0.91
From a young oak stand	0.01
From a canyon partly (43 per cent) covered with brush	0.15

Professor Roschin, in a study in Transcaucasia of the influence of ground litter cover on superficial run-off and percolation, discovered that percolation through

a 5-centimeter layer of litter varied from 9 to 45 seconds, depending on the compactness of the litter. Rates of percolation were found to bear a certain relation to the thickness of litter cover within various forest types. Also thickness of vegetative litter cover appeared to be a function of steepness of slope and density of forest stand. A total of 246 samples of litter were taken, and showed that density of stand was of more influence than gradient of slope. A comparison of rates of run-off from a slope of 25° in one case covered with ground litter and in another case, bare, showed that the rate of run-off from the bare slope was 40 times greater than from the litter covered slope. A series of studies showed also that the ground litter cover is more important in favoring percolation and in reducing superficial run-off than the forest stand. Flood and erosion control studies in Transcaucasia include surveys to map the areas covered by forest litter areas subject to floods and erosion as it affects the production of silt.

N. T. Mirov,
University of California.

SOCIETY AFFAIRS

The Correspondence Department

With the January 1931 issue of the Journal the Editor inaugurated a "Correspondence" department. It was intended to offer the readers a more convenient medium for personal expression in controversial and live topics of the day or in the way of discussion, criticism or elaboration to articles published. To date the department has been used so little that some issues have gone to press without it. However, this does not mean that the department is abandoned. The Editor will be glad at any time to consider, for publication, the comments of readers in the form of letters.

Emanuel Fritz, *Editor*.

Doings of the Executive Secretary

Ways and means to improve employment opportunities in the profession have absorbed much time and thought. In this connection recent correspondence with Dean Graves may be of interest. On August 15th, Dean Graves wrote the Executive Secretary as follows:

"I was particularly interested in the copy of your letter of August 11th addressed to the Society sections. This is splendid work. My experience in placing men last spring convinced me that the old sources of employment have for the time being almost dried up. This means that we must develop new avenues of employment. I presume that the unemployment activities in the different states will open the way for some men temporarily. About all we can do now is to help find temporary employment. It is probable that a good many temporary positions will become permanent if the men do good work. Even if you should not succeed in placing many men, the very fact that your office is doing everything in its power will have a splendid effect on the profession."

The Executive Secretary made the following reply:

"Thank you for your letter of August 15th. A word of commendation from you means much to me.

"After all is said and done, however, my letter to the section officers on unemployment relief for Society members is little more than a pretty gesture. It may show that the Society has good intentions and that its heart is in the right place; but it does not create the jobs that are needed.

"I am hoping that the 'Financial Control' idea, which was expressed first in Granger's letter to the Director of the Reconstruction Finance Corporation and which he discussed further with you in New Haven, will be a step in that direction.

"Our banking institutions, as they come to assume toward forest investments and loans to forest industries the attitude of the Swedish bankers, will to the same extent find increasing need for the services of trained foresters. William L. Hall, as you undoubtedly know, has been performing such services for a bank in Arkansas, and the Federal Land Bank of Springfield has for several years been employing a forester as its chief appraiser.

"Maybe this is one of the new avenues of employment to the development of which the Society should devote its effort. Probably you have others in mind. Certainly both the Society and its Executive Secretary could furnish no better excuse for their existence than to work successfully along such lines.

"In this connection, may I bother you with a recent letter to Philip W. Ayres (copy enclosed). Are there not new avenues of employment susceptible of develop-

ment in this field? It seems to me that the management of a forest whose primary purpose is recreation is just as much the function of a trained forester as is the raising and harvesting of commercial timber crops or the maintenance of a protective cover on a watershed, and, therefore, that the superintendent of a forested park, like the Great Smoky or Shenandoah, should be a trained forester. . . . . The objective is to preserve the primeval forest, where it still exists, and to restore to something akin to primeval conditions, the cut over areas. Effectively to accomplish such ends requires a practical working knowledge of silvicultural principles to the same degree as if the objective were a good crop of saw logs."

The above mentioned letter to Philip W. Ayres, Forester of the New Hampshire Society for the Protection of Forests dealt with the need for systematic and comprehensive analysis and evaluation of forest recreation uses and possibilities as a basis for proper coördination of their conservation and development with other essential forest uses. It pointed out the growing importance of recreation in the forestry field and emphasized that the problems involved are clearly the responsibility of the professional forester. Your Executive Secretary was invited by the New Hampshire Society to speak on the subject at its September meeting. He was unable to accept because the date conflicted with that of the New York Section meeting, but his letter was read and it is understood, served as the preliminary to constructive discussion participated in by members of our own Society.

FRANKLIN REED,
Executive Secretary.

TENTATIVE PROGRAM OF ANNUAL MEETING

The Annual Meeting of the Society to be held at San Francisco in December promises to be one of more than ordinary interest.

The central theme of the program is review of the major conservation problems of the Nation and of the responsibilities that their solution places on the shoulders of the profession. The program for December 14 and 15 is outlined as follows:

Address by the President of the Society.

Address by Dean H. S. Graves, Yale University, on the central theme of the meeting.

Conservation and the national government (Major R. Y. Stuart, Chief Forester, Washington, D. C.).

The principles of conservation in the use of wild land (S. B. Show, Regional Forester, San Francisco, Cal.).

The timber problem in conservation.

The water conservation problem in forestry.

The place of recreation in the forest program.

Parks as a form of land management and conservation (Mr. Horace M. Albright, Director, National Park Service, Washington, D. C.).

Conservation and state governments.

The outlook for timber management by private owners.

Game management in the conservation program.

The individual papers will be followed by discussions under designated leaders.

One full day, December 16, is given over to Society affairs, many of which need the careful consideration of the membership.

The ladies accompanying the members will find the most hospitable reception which promises a delightful stay in the old city by the Golden Gate. Last but not least, elaborate preparations are made by the California Section for the entertainment of the members at the annual banquet on December 15.

There will be ample opportunity for excursions. From Sunday, December 11 to Tuesday, December 13 interested parties may visit the famous redwoods, the Yosemite Valley or the pine forests. Good weather can generally be reckoned upon in

December. For December 17 and 18, our southern California members have arranged highly interesting excursions out of Los Angeles into regions little known to the average forester in which important developments are taking place, particularly in watershed management and in recreational use.

The Hotel Bellevue, Geary Street at Taylor, has been chosen as Headquarters. It offers very attractive rates from $2.50 up, all rooms with bath. The meeting will be held in the large auditorium of the Pacific Gas and Electric Company, 245 Market Street.

But aside from these allurements which, in other forms, go with most annual gatherings, a special significance attaches to the San Francisco meeting. Forestry stands at the crossways. A crisis is approaching, and the Society and each of its members must do their part in meeting it.

E. P. MEINECKE,
Chairman, Committee on Meetings.

TRANSPORTATION FACILITIES TO ANNUAL MEETING

The arrangements made by the SANTA FE RAILWAY SYSTEM for special cars from Chicago westbound and from Los Angeles eastbound for accommodation of our members attending the convention in San Francisco, outlined in advertisement on page (?) of this issue, are certain to insure a comfortable and highly enjoyable journey.

Leaving Chicago from Dearborn station, the SANTA FE passes through Illinois, a corner of Iowa and Missouri and the fertile fields of Kansas, entering Colorado at Holly, the beginning of the Arkansas Valley irrigated district.

Leaving Trinidad, Colorado, a helper engine is attached for the climb over Raton Pass (altitude 7,608 feet); into New Mexico and the "Southwest Land of Enchantment," a region rich in scenery and legend.

Members using the Grand Canyon Limited, may avail themselves of the opportunity to make the one hour Isleta Indian detour in comfortable coaches from train at Albuquerque back to same train at Isleta—thirteen miles beyond—at cost of one dollar.

Enroute through New Mexico and Arizona, the road climbs the Continental Divide 150 miles beyond Albuquerque; thence through fragrant pine forests to Williams, the branch line point for the Grand Canyon of Arizona.

Of the Grand Canyon much has been written. The mere statement that it is the greatest scenic wonder in the civilized world tells little of its immensity, its magnificent coloring, and, greater than all, its uncanny power of the emotions.

Leaving Grand Canyon the route across Arizona and California is through Needles, Cal., (Where the Colorado River is crossed) the great fruit raising section of the San Joaquin Valley, and Merced (gateway to the Yosemite National Park).

SECOND SUMMER MEETING, OZARK SECTION

The second summer meeting of the section which was held June 25th was quite successful and well attended. (The secretary offers his apology for not having written these notes earlier.) Eighteen members and 16 guests were present. The day started by a trip through the mill of the Caddo River Lumber Company. Following dinner, the group made an inspection trip of the woods operations of the Caddo River Lumber Company which was followed by a short tour through some of the best virgin pine timber in the State. Through the courtesy of the Ouachita National Forest and the Oklahoma Forest Service, an excellent demonstration was given in fire line construction. A new water pump attachment for a Ford was

also demonstrated. A timber estimating contest was held and the honors went to A. C. Shaw and Bill Paddock who tied for the prize which was a double-bitted hand axe and sheath. Mr. Shaw won the axe on his ability in matching coins. An exceptionally fine business meeting was held during the evening. The following resolution has been submitted to the members of the section for their action:

"BE IT RESOLVED by the Ozark Section, Society of American Foresters, *that* we hereby concur with the principles of geographic representation, on a regional basis, for election of officers and council members of the Society, as outlined by the Northern Rocky Mountain Section, as effectively filling the requirements of a simple, representative, and efficient form of government for the Society."

CHARLES A. GILLETT,
Secretary.

ALLEGHENY SECTION MEETS

The eleventh annual summer field meeting of the Allegheny Section was held on the Allegheny National Forest on July 28, 29 and 30, 1932. A total of 90 members and guests including a number of members of the New York Section were present.

During the three days many points of interest in the national forest were visited including picnic areas, fire and road equipment depots, fire towers and similar points of interest. Demonstrations of fire pumps, road building equipment and fire line building equipment were made at different points.

The features of the trip were the magnificent stands of virgin timber in Hearts Content and on the east branch of the Tionesta, which were visited. Many wonderful specimens of white pine, hemlock and various hardwoods were observed in these beautiful areas. Lunch, donated by the Waddingham Tractor Company and the Warren Chamber of Commerce, was served in the Hearts Content area which is owned by the Forest Service. The visit to the east branch of the Tionesta tract which is owned by the Central Pennsylvania Lumber Company, was made on a logging train, after which the main mill of the company was visited.

The banquet was held at the Warren Outing Club on Friday evening, and consisted of a genuine Swedish "Smorgasbord" in which scores of delectable but unpronounceable dishes were tasted by those present. Chairman L. E. Staley, acting as toastmaster, called upon the following who responded with short talks: F. W. Besley, State Forester of Maryland; C. P. Wilber, State Forester of New Jersey; W. S. Taber, State Forester of Delaware; R. D. Forbes, Director of the Allegheny Forest Experiment Station; L. L. Bishop, Supervisor of the Allegheny National Forest; R. R. Houpt, District Forester; A. B. Recknagel, representing the New York Section; H. N. Cope, Director of the Penn State Summer Camp; J. H. Howell of the Caterpillar Tractor Company, and Franklin Reed, Executive Secretary of the Society. The Secretary-Treasurer presented informal reports and gave a resumé of Section business since the annual meeting.

H. F. ROUND,
Secretary.

ANNUAL SUMMER MEETING OF THE NEW ENGLAND SECTION

The annual summer meeting of the New England Section was held August 1 and 2 at the Groton State Forest in Vermont, the Vermont Forest Service acting as host. Nearly 70 members and guests enjoyed two full days of camping and tramping in one of the most beautiful sections of the state. The headquarters camp was conveniently situated in a clearing within the Forest. Nu-

merous trails or woods roads led from camp to all parts of the Forest, including several small lakes, a number of fairly high peaks, a forest products depot at the railroad, and numerous other points of interest.

A printed program described seven different one-half day trips so planned as to take in interesting and representative conditions of the forest, and to permit the division of the party into small groups each with a guide. This innovation proved to be very satisfactory since members were able to choose those trips which best suited their individual tastes, and the unwieldiness of a single large party was avoided. The Groton Forest comprised some 15,000 acres of cut-over, culled, and burned land at the time of its acquisition in 1919-22. The three major forest types are burned hardwoods, culled northern hardwoods, and culled softwoods. The burn type predominates. Most of the forest is young, but there are certain areas containing merchantable timber, and on these stumpage sales have been made during the past eight years. Poplar has been cut for pulp and excelsior; birch, ash, spruce and fir for lumber; mixed hardwoods for fuel. In addition there have been sales of Christmas trees from both planted and natural stands.

During the course of the field trips many interesting discussions took place regarding the effects of the method of cutting on reproduction, rotations for the different hardwood species, — paper birch, poplar, white ash, yellow birch, etc., the conversion of the burn type to a more valuable composition, improvement cuttings in culled hardwood stands, and the condition of the numerous plantations set out on abandoned farm land. Considerable porcupine and squirrel damage was in evidence in the plantations, and a moderate amount of weeviling. On a neighboring forest a heavy attack of blister rust was observed in a white pine plantation.

A business meeting was held around a large camp fire the second evening in camp. Chairman A. C. Cline, and A. F. Hawes, Member of the Council, discussed the new membership manual of the Society, and as many Section committee chairmen as were present were called upon to report briefly on the progress of their respective assignments. A resolution recommending the use of unemployment funds for public forestry work was adopted, and ordered sent to the governors of the New England states and to the press. The Chairman appointed a special committee to give publicity to the resolution. The Section voted to hold the annual winter meeting at Manchester, N. H. Following the transaction of business the Chairman called on Professor L. R. Jones, well known plant pathologist of the University of Wisconsin and one of the early supporters of the state forestry in Vermont, Dean C. D. Howe of the University of Toronto, and Dean Hugh P. Baker of the New York State College of Forestry for short talks. Especially interesting for the occasion were the accounts of the inception and growth of the Vermont Forest Service as given by Professor Jones, former Forest Commissioners Hawes and Ross, and present Commissioner Merrill.

H. J. MacAloney,
Secretary, New England Section.

Pack Forestry Fellowships Available

Application for fellowships in forestry for the year 1933-34 are now being received by the Charles Lathrop Pack Forest Education Board.

Approximately six fellowships are available and will range from $500 to $1,500, although in special cases higher sums may be authorized by the Board.

Appointments may be made for twelve months or for longer or shorter periods, in accordance with the scope of the work, and may be renewed at the discretion of the Board. The amount of the grants will in each case be determined by individual circumstances.

Fellowships will ordinarily be restricted to men of American or Canadian citizenship, but there are no restrictions as to age, educational status or personal experience. However, fellowships will be granted ordinarily only to those who have finished an undergraduate college course or its equivalent.

The awards will be made to men who demonstrate natural powers of intellectual and personal leadership and who intend to make forestry their life work. Special emphasis is placed on character, intellect, imagination, industry and personal interest in forestry. The Board seeks all possible information concerning candidates from former teachers, associates, employers and others.

Appointments will be made by the Board on recommendation of a Committee on Appointments, consisting of Henry S. Graves, John Foley, and Tom Gill.

Applications for fellowships must be made in writing on prescribed forms on or before December 31, 1932, to the Secretary of the Charles Lathrop Pack Forest Education Board, 1214 Sixteenth Street, N. W., Washington, D. C. Application forms will be mailed by the Secretary on request.

For the present year the Education Board has announced its selection of three Americans and two Canadians. The successful candidates were:

Weston Donehower, Graduate Student, Department of Forestry, Cornell University. To make a study of the management of red spruce for pulpwood production in the Northeastern States.

John Edward Liersch, Junior Forester, British Columbia Forest Service, Victoria, Canada. To demonstrate, through coöperation with interested logging companies, the practicability of economic selection in the Douglas fir region.

Ralph Melvin Lindgren, Graduate Student, University of Wisconsin. To do research on factors affecting initial infection and subsequent development of wood deteriorating fungi which attack lumber and logs.

Harold John Lutz, Graduate Student, Yale University. To continue ecological study of the "Plains" areas of southern New Jersey begun under Charles Lathrop Pack Fellowship awarded in 1931, with particular reference to soil conditions insofar as they may be related to the peculiar vegetational development.

Louis Rene Scheult, Graduate Student, University of Toronto, Canada. To make a study of the use of motor trucks in woods operations with special application to conditions in eastern Canada.

Past Presidents of the Society

Gifford Pinchot	1905, '08, '10, '11	
Overton W. Price	1908-09	(deceased)
H. S. Graves	1912	
W. L. Hall	1913	
B. E. Fernow	1914, '16	(deceased)
W. B. Greeley	1915	
Filibert Roth	1917	(deceased)
F. E. Olmstead	1919	(deceased)
R. C. Bryant	1920, '21	
E. A. Sherman	1922	
R. S. Hosmer	1923	
Walter Mulford	1924	
S. T. Dana	1925, '26	
R. Y. Stuart	1927	
O. M. Butler	1928	
P. G. Redington	1929, '30-31	

A Letter From Dr. Fairchild

October 13, 1932.

Mr. Franklin Reed, *Executive Secretary*,
Society of American Foresters.

Dear Mr. Reed:

The recent publication of the Report of the Timber Conservation Board, coupled frequently with the list of names of those who served upon the Board's Advisory Committee, will naturally lead most readers to infer that the Board's conclusions and recommendations are based upon findings of its Advisory Committee. Having been a member of the Advisory Committee and Chairman of its Subcommittee on Taxation, I feel that I owe it to the public in general and to the forestry profession especially to state that, as regards the subject of taxation, this inference is not warranted.

On the subject of taxation the Report of the Board has this to say:

"The present and prospective annual burden of taxation on mature standing timber distinct from the land upon which it grows is the most important single present factor forcing the sale or cutting of timber without due regard to the current market demand for forest products. . . . .

"The present and future security of private ownership of merchantable standing timber as well as the maintenance of reasonable current balance between production and consumption of forest products, requires the substitution, in the principal timber states, of an equitable system of income or yield taxation for the present prevailing system of property taxation."

The Subcommittee on Taxation, consisting of six members of the Advisory Committee, submitted a comprehensive report, which has as yet not been published. This report does not recommend the yield tax or any other specific plan of forest taxation, but points out that the entire subject has been studied very thoroughly by the Inquiry and that recommendations may be expected from that source in the near future.

Moreover, the conclusion of the Taxation Subcommittee on the effect of taxation on timber cutting, two members (Allen and Sisson) dissenting on this point, was quite at variance with that of the Timber Conservation Board. It reads as follows:

"It should be emphasized that the special problem of forest taxation relates chiefly to the business of forest growing, including precautions in cutting designed to keep forest lands productive, rather than to the business of exploiting mature timber. That the prevailing American tax system may act as an undoubted obstacle in the way of the reforestation of cut-over lands has been shown above in general terms, and there is much evidence in confirmation of this proposition. That up to the present taxation has by and large had any widespread substantial effect upon the time and rate of cutting of the American forests or in hastening over-production of lumber is not supported by the evidence, although it may well be that in individual cases taxes have actually furnished the controlling motive to cutting."

The Subcommittee Report presents at length the evidence and reasoning in support of this conclusion. It does not at all minimize the importance of taxation as a secondary cause of liquidation and as an obstacle in the way of the business of forest growing, and it makes clear that the case for reform in the taxation of forests rests on more fundamental and better established grounds than those asserted by the Board.

The Timber Conservation Board was of course acting within its rights in rejecting the advice of its Advisory Subcommittee on Taxation. My purpose in writing this letter is only to relieve myself and the other majority members of the Subcommittee from responsibility for the Board's findings and recommendations.

Very truly yours,

Fred R. Fairchild,
Director, Forest Taxation Inquiry.

William Willard Ashe

Announcement of the death of William Willard Ashe was made in a note on page 652 of the May issue of this Journal. Mr. Ashe's contributions to forestry were of such outstanding merit that further notes upon his achievements seem necessary both in appreciation of the services of a valuable member of the Society of American Foresters and for purposes of historical record. There follow two tributes by men who knew this modest, painstaking, prodigious worker well.

E. A. Sherman, Associate Forester, U. S. Forest Service, speaks thus of Mr. Ashe, as an expert in the value of timberland and as a researcher: "Ashe took with him to the grave a million dollars worth of information that no one else can supply. His work was not finished, and now never will be. During the past 18 years I learned to rate Ashe as the best judge of values of timber and timberlands east of the Mississippi. I also learned to appreciate his work in the field of research. Always charged with man-sized administrative jobs, he nevertheless made a number of important contributions to economic progress. He was a pioneer in advocating the terracing of farm lands in North Carolina; he demonstrated to the lumbermen that they were losing money by cutting small trees; and he analyzed the financial limitations of protecting reservoir capacity from loss by silting.

"His knowledge of timber and timberland values was uncanny. More than once I have seen "Acquisition men" almost in tears because Ashe had recommended against the purchase of some particularly desirable tract at a price which he believed to be too high, although the examiner considered it a bargain at that price and believed the Service, in rejecting it, would be overlooking an opportunity it never would have again. Nearly always Ashe's judgment was vindicated by the owner sooner or later accepting the price which Ashe had indicated as representing the fair going value of the property under existing market conditions. Of course, he was not absolutely infallible, but nearly always he was right. We all grew to accept his judgment as final. In all the years past I never once recommended the purchase of a tract of land at a cent higher than Mr. Ashe indicated.

"Looking back over the years, and considering Ashe's contribution to research, it is a matter of personal regret that so much of his time was occupied on what might be termed administrative jobs. The truth is he could save the Government so much money in our purchase negotiations that the temptation to use him on this work was irresistible. To say that he saved the Government on the average annually not less than $100,000 in cash outlay on individual purchases and by the establishment of reasonable price levels for land, would not, in my judgment, be an over-estimate. And yet his little leaflet entitled *Small Trees Wasteful to Cut For Saw Timber* doubtless saves the lumber industry annually throughout the country many times this amount, in addition to leaving the cut-over lands in better condition for future timber crops.

"But the loss to the Forest Service and to forestry in America resulting from the death of Ashe cannot be measured in dollars and cents. He was a lone worker, independent in thought and intellectually honest. Few people knew him really well. His mind sought out special fields of interest which it searched by paths of his own pioneering. He was too intent in his search for truth to ask for outside help. He did not indulge in propaganda. Usually if you wished to know his opinion on any subject he had to be asked outright. When asked, he gave it clearly but with brevity approaching abruptness. He never sought to soften it or qualify it to conform to the views of his questioner. Apparently, since he stated only what he believed to be true, he felt the truth required neither apology nor defence."

Mr. Ashe was also a botanist of note. Dr. W. C. Coker, Professor of Botany, University of North Carolina, considered him "the greatest source of knowledge of southern botany." His accomplishments in this field are summarized by Wm. A. Dayton, Plant Ecologist, U. S. Forest Service in the following words: "Ashe, his family report, was noted as a boy for his love of nature. When he sought to enter the University of North Carolina in 1898 as a sophomore he lacked one credit for matriculation, studied botany under an aunt during the summer vacation and, upon standing his entrance examination, surprised Dr. J. A. Holmes with his knowledge of plants. Both at North Carolina and Cornell he specialized in botany and geology, and the former science became his life-long avocation and hobby.

"Although his botanizings were conducted chiefly on his own time or if, in connection with his official duties, necessarily as a sideline, Ashe was an indefatigable observer, collector, and annotator of plants. Few, if any, were his equals in first-hand knowledge of the flora and vegetative types of the southeastern states, more especially of the woody plants and of the less accessible areas. His eye was exceedingly acute to detect differences and, while his specific concept did not always suit the more conservative, numerous of his species and varieties undoubtedly will survive the inevitable sifting process of critical review. In all Ashe published 510 new botanical names, including 177 in Crataegus, 60 in Hicoria (syn. Carya), 47 in Panicum, 43 in Quercus, 33 in Azalea (syn. Tsutsusi), 24 in Polycodium, 15 in Castanea, and 13 each in Robinia and Tilia. While the critical reviewer may perhaps regret a certain amount of nomenclatural vacillation in his work yet the fair-minded cannot withhold wholehearted admiration and astonishment at the extraordinary energy, industry, and prolificacy of this man who, in those spare moments spent by so many profitlessly, produced a richer harvest of published results than many of us seem able to achieve from years or routine toil.

"Six trees and two shrubs of the Southeast, besides one widely distributed grass of the eastern states, perpetuate his name: *Castanea ashei* Sudw., *Crataegus ashei* Beadle, *Hicoria ashhei* Sudw., *Juniperus ashei Buchholz*, *Magnolia ashei* Weatherby, *Panicum ashei* Pearson, *Polycodium ashei* Harbison, *Quercus ashei* Trel., and *Schmaltzia ashei* Small.

"Ashe was appointed a member of the Forest Service Tree Name Committee in 1928 and served as chairman of it from 1930 to his death. He was a prolific writer, and published upwards of 166 scientific papers. He prepared the Robinia chapter of the second edition of Small's *Flora of the Southeastern United States* and the oak portion of *Standardized Plant Names.* In a bibliography of Ashe's published papers prepared by the writer 54 titles are in dendrology and other phases of systematic botany, 9 concern ecological subjects—chiefly forest types, 3 papers deal with English plant nomenclature, and 2 papers are on floristics (lists of trees and shrubs).

"Ashe had an enormous private herbarium housed at Raleigh, N. C., and also at his residence, Washington, D. C. Presumably it contains his type material. It is unfortunate, from the standpoint of botanical science that a set of these types, or isotypes, is not on file in the U. S. National Herbarium or some other suitable repository. Hitchcock and Chase, in their treatment of the genus Panicum (Contrib. U. S. Natl. Herbm. 15: 2. 1910) have hinted at the handicap they were under in monographing this largest and most difficult of American grass genera by the inaccessibility of Ashe's types. This situation, the writer hopes, may some day be corrected not only for the sake of American plant taxonomy but in protection of the scientific labors of a distinguished forester and high-minded southern gentleman whose memory and whose friendship he prizes highly."

Adolf Oppermann
1861-1931

In announcing the death, on November 16, 1931, of Adolf Opperman in its January issue, the Journal promised a brief sketch of his achievements. The following notes were compiled by Messrs. L. G. Romell, S. O. Heiberg and C. C. Heimberger, to whom acknowledgment is greatfully made.

Although never a practising forester, Dr. Oppermann has stood for decades as the personification of Danish forestry. Himself a descendent of several generations of Danish foresters, he became the historian and systematizer of the valuable forestry experiences long accumulated in a country where scientific studies in forestry were started in about 1793 by Count Reventlow. With his exceptional memory, keen historical interest and outstanding scholarship, Oppermann was unusually well equipped for this task. He also had the fortune of getting his training under the genial P. E. Müller, and of starting work at a time when the reforestation work in the heaths, started by E. M. Dalgas, had given a new impetus to the forestry profession in Denmark.

Outstanding results of Oppermann's scholarship are his studies in the history of Danish forestry, from 1786 to 1886 *Tidsskr. f. Skovbr.*, (1889), his account of Danish forestry legislation, 1660-1924 (Copenhagen, 1929), and the bibliography of Danish forestry literature up to 1925 *Bibliographia univ. silv. I. Dania*, (by A. Oppermann & V. Grundtvig, Copenhagen, 1932), the manuscript of which he finished just before his death. Together with L. A. Hauch, he wrote the standard Danish manual on forestry, *Haanbog i Skovbrug*, 1898-1902. In another textbook, *Trae og andre Skovprodukter*, 1916, he treated technology and utilization.

The results of Oppermann's own research work are mostly printed in the publications of the Danish forest experiment station *Det forstlige Forsogsvaesen i Danmark*. The most important among them pertain to the heredity of poor form in beech (1908); to the manufacture and use of Danish wood ('06, '11, '20, '22, '29); and to the growth and development of conifers cultivated in Denmark (Norway spruce, '08, '13, '22; fir, '12; different pines, '16, '22, '24; larches '23, '30; Douglas fir, '12, '15, '22, '29; Sitka spruce, '22, '29).

Oppermann graduated from the Royal Agricultural College in Copenhagen in 1883 and remained in its Forestry Department until 1917, first as assistant, from 1887 as lecturer, and from 1895 as professor. In addition, he was in charge of the state forest experiment work from its organization in 1901. In 1917 an independent forest experiment station was created, and Oppermann was made its director. He remained active in this capacity until his death.

Oppermann was made a corresponding member of the Society in 1924. Similar honors were awarded him from other countries. He was a member of the French Academie d'agriculture (as the only foreign forester) and was made Doctor, *honoris causa*, by the Hochschule für Bodenkultur in Vienna.

L. G. Romell, S. O. Heiberg,
and C. C. Heimberger.

Frank J. Klobucher
1888-1932

After an illness of only five days, Frank J. Klobucher died of pneumonia on March 18, 1932 in Portland, Oregon at the age of 42 years. He graduated from the College of Forestry, University of Washington, in 1914 and from the Yale School of Forestry in 1916. He was a senior member of the Society of Ameri-

can Foresters. The biographical note which follows is by E. S. Atkinson and is taken from the *Yale Forest School News* of July, 1932.

"After graduation, he entered the U. S. Forest Service with headquarters at Missoula, Montana. With our entry in the war, he joined the 20th Engineers and went to France where he remained for nearly two years, actively engaged with the operations of the 20th Engineers. After the Armistice, he returned again to Missoula, Montana with the Forest Service. He left the Forest Service in 1923 and moved to Burns, Oregon in the employ of the Fred Herrick Lumber Company, as the General Superintendent of the mill and railroad. Frank remained with Mr. Herrick until the fall of 1928, at which time the company was sold to Mr. Edward Hines of Chicago. While with the Herrick Lumber Company, he devoted a large part of his time to the construction of a 90-mile branch railroad, the Herrick Railroad, from Burns to Seneca.

"Since 1928 he had been living in Portland, Oregon, being employed by the James D. Lacey Company of Chicago. In April, 1931, he was sent to the Philippines by this company to investigate and report on a mill and logging operation. Last October he returned to this country after completing the work in the Philippines.

"In a letter received from him some years ago, he said, among other things, the following which I quote: 'Sometimes when I'm pretty well disgusted with all the red tape and the obstacles and the rate of progress we are making, I recall some of the things we were taught back at the Yale Forest School. If I received nothing else except that which I acquired in the way of an ideal, or of a vision, or whatever you call it, I would still feel that I owe to my associations with our professors a big share of what little progress I have so far been able to make.' . . .

"On May 27, 1925 he was married and is survived by his wife, Jeane C. Klobucher and a small son Jimmie, two years old. Mrs. Klobucher and son have now returned to their home, Burns, Oregon. He is also survived by his mother, Mrs. Louise Klobucher, of Opportunity, Washington, as well as three brothers and three sisters. His father died last August. . . ."

Have You Recently Changed Your Address?

Make sure that we have your correct address and insure prompt delivery of the Journal. All changes should be sent to the Society's office.

FORTHCOMING EVENTS

32nd Annual Meeting
Society of American Foresters
December 14-18, 1932
San Francisco, Calif.

Annual Meeting
Central States Forestry Congress
November 17-19
Brown Hotel
Louisville, Ky.

Section secretaries are welcome to use this box for announcing their meetings. Copy should be in the hands of the Editor or Executive Secretary one month before date of publication.

PERSONALS

Charles H. Herty, inventor of the Herty cup and well known for other work in connection with naval stores, has been awarded a medal by the American Institute of Chemists for "noteworthy and outstanding service to the science and profession of chemistry in America."

Samuel J. Record, professor of forest products at Yale University, has been elected secretary-treasurer of the International Association of Wood Anatomists. The purpose of this association, which was organized in Paris last July in conformity with resolutions adopted by wood anatomists attending the Fifth International Botanical Congress at Cambridge, England, in 1930, is to coöperate in a systematic investigation of the woods of the entire world through the pooling of materials, standardization of terminology and descriptions, and the exploration of little-known forest regions.

Professor Harry R. Francis has been appointed a member of the technical committee on forests, parks, recreation and wild life preservation areas which is a sub-committee of the land-use planning committee of the National Conference on Land Utilization held in Chicago recently under the auspices of the Association of Land Grant Colleges and Universities.

Charles W. Boyce is now administrative head of the American Paper and Pulp Association, with the title of Executive Secretary. Jesse Neal, General Manager, has resigned.

Ward Shepard has been selected by the Oberlaender Trust, an integral part of the Carl Schurz Memorial Foundation, in Philadelphia, to devote a year to the investigation of the economic and social phases German forestry as a contribution to th development of American forest polic Shepard is now engaged in extensive trav in Germany and later on will put in sever weeks in Austria.

Henry I. Baldwin, formerly in charge forest investigations for the Brown Com pany, Berlin, New Hampshire, will spen the academic year 1932-1933 teaching sil viculture in the Department of Forestr The Pennsylvania State College, State Co lege, Pa., substituting for Assistant Pr fessor H. J. Lutz, who is studying for th Ph.D. degree at the Yale University.

R. D. Forbes, director of the Alleghen Forest Experiment Station, has bee awarded an honorary degree of Master o Arts from Williams College.

B. F. Jones, of the Great Norther Paper Co., Raymond E. Rendall, of Bate College, and Austin Cary and C. R. Til lotson, of the United States Forest Serv ice, have been asked by Forest Commis sioner Violette, of Maine, to serve on a advisory committee for Indian Townshi a state-owned area near Princeton in east ern Maine that is to be put under fores management.

Record of Members

Our record of members giving thei training and experience, professiona standing, and qualifications for differen lines of forestry work, started something over two years ago, is getting a bit out o date and therefore is not so fully usefu as it should be in meeting inquiries from prospective employers. If there has been any recent change in your personal status won't you please advise this office im mediately. Keep us particularly advised if you are definitely in the market for a new position.

Announcement of Candidates for Membership

The following names of candidates for membership are referred to Junior Members, Senior Members and Fellows for comment or protest. The list includes all nominations received since the publication of the list in the October Journal, without question as to eligibility; the names have not been passed upon by the Council. Important information regarding the qualifications of any candidate, which will enable the Council to take final action with a knowledge of essential facts, should be submitted to the undersigned before December 1, 1932. Statements on different men should be submitted on different sheets. Communications relating to candidates are considered by the Council as strictly confidential.

FOR ELECTION TO GRADE OF JUNIOR MEMBERSHIP

Name and Education	*Title and Address*	*Proposed by*
Coile, Theodore S. Ohio State U., 2 yrs.; U. of Mich., 1 yr.	Research Assistant, Duke Forest, Durham, N. C.	Appalachian Section
Drake, James D. L. U. of Wash., B. S. F., '30.	Resident Forester, Long Bell Lbr. Co., Longview, Washington.	North Pacific Section
Johnson, Robert B. U. of Idaho, B. S. F., '32.	Senior Forest Ranger, U. S. Forest Service, Pine, Idaho.	Intermountain Section
MacDill, Julia Lee Bryn Mawr College, A. B., '27; Yale U., M. S. F., '31.	Acquisition and management of a tract of land in Vermont, Woodstock, Vt.	New England Section
Mathews, John Thomas Wash. State College, 1 Yr.; U. of Mont., B. S. F., '30.	Assistant to Ranger, Wyoming N. F., U. S. Forest Service, Kemmerer, Wyo.	Intermountain Section
Mills, Russell U. of Wash., B. S. F., '22; Graduate work at U. of Wash., 1 yr.	Associate Professor Forestry, U. of Wash., Seattle, Washington.	North Pacific Section
Steele, Foster U. of Oregon, special work.	Assistant Supervisor, Cascade N. F., Eugene, Oregon.	North Pacific Section

FOR ELECTION TO GRADE OF SENIOR MEMBERSHIP

Black, S. Rexford U. of Mich., B. S. F., '16. (Junior Member, 1927.)	Secretary-Manager, California Forest Protective Assn., San Francisco, Calif.	California Section
Burton, Sidney S. U. of Minn., B. S. F., '23. (Junior Member, 1925.)	In charge, Arboricultural Investigations, Southern Great Plains Field Station, Woodward, Oklahoma.	Ozark Section
Craddock, George W. Jr. U. of Calif., B. S. Agr., '27, M. S. F., '29. (Junior Member, 1928.)	Associate Range Examiner, Intermountain Forest and Range Exp. Station, U. S. Forest Service, Ogden, Utah.	Intermountain Section
Humphrey, Joseph W. Correspondence courses. (Junior Member. 1927.)	Forest Supervisor, Manti Forest, U. S. Forest Service, Ephraim, Utah.	Intermountain Section
Martin, Wilson Mich. State College, B. S. F., '25. (Junior Member, 1928.)	District Forester, Tennessee Forest Service, Dickson, Tenn.	Ozark Section
Potter, Arthur U. of Idaho, 5 months; U. of Mont., 2 winters. (Junior Member, 1927.)	Assistant Forest Supervisor, Boise N. F., U. S. Forest Service, Boise, Idaho.	Intermountain Section
Ritter, Edward U. of Wash., B. S. F., '26; Yale U., M. F., '31. (Junior Member, 1928.)	District Ranger, Sawtooth N. F., U. S. Forest Service, Hailey, Idaho.	Intermountain Section

C. F. Korstian,

Member of Council in Charge of Admissions.

Make Your Plans Now to Attend the

ANNUAL MEETING OF THE SOCIETY OF AMERICAN FORESTERS

December 14-18, 1932, San Francisco, Calif.

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Vice-President, John D. Guthrie, Forest Service, Portland, Oregon.
Secretary-Treasurer, Paul G. Redington, Biological Survey, Washington, D. C.

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The Council consists of the above officers and the following members:

	Term expires		Term expires
Ralph S. Hosmer	Dec. 31, 1933	E. L. Demmon	Dec. 31, 1935
Clifton D. Howe	Dec. 31, 1933	A. F. Hawes	Dec. 31, 1935
Stuart B. Show	Dec. 31, 1933	C. F. Korstian	Dec. 31, 1935
Claude R. Tillotson	Dec. 31, 1933	Hugo Winkenwerder	Dec. 31, 1935

Member in Charge of Admissions

C. F. Korstian

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Editor, Journal of Forestry

Emanuel Fritz, 231 Giannini Hall, Berkeley, Calif.

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H. F. Round, Secretary, Forester's Office, Pa. R. R. Co., Philadelphia, Pa.

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I. H. Sims, Secretary, Appalachian Forest Experiment Station, Asheville, N. C.

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George Cecil, Vice-Chairman, Chamber of Commerce, Los Angeles, Calif.
Russell Beeson, Secretary, U. S. Forest Service, San Francisco, Calif.

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Lynn H. Douglas, Secretary-Treasurer, U. S. Forest Service, Denver, Colo.

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Intermountain

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Arthur G. Nord, Vice-Chairman, U. S. Forest Service, Salt Lake City, Utah.
G. W. Craddock, Jr., Secretary, Intermtn. Forest & Range Exp. Sta., Ogden, Utah.

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H. J. MacAloney, Secretary, Northeastern Forest Exp. Sta., 335 Prospect St., New Haven, Conn.

New York

Hugh P. Baker, Chairman, N. Y. State College of Forestry, Syracuse, N. Y.
H. C. Belyea, Secretary, N. Y. State College of Forestry, Syracuse, N. Y.

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G. M. DeJarnette, Secretary, N. Rocky Mt. For. Exp. Sta., Missoula, Mont.

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Wisconsin

H. Basil Wales, Chairman, U. S. Forest Service, Milwaukee, Wis.
A. G. Hamel, Secretary, 4420 W. Wright St., Milwaukee, Wis.